EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.,
Petitioner,

v.

WSOU INVESTMENTS LLC.,
Patent Owner.

Case No. IPR2021-01400

Patent No. 8,712,708

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,712,708 (CLAIMS 1-2, 4-7, & 13-16)

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I. INTRODUCTION

Petitioner requests *Inter Partes* Review ("IPR") of claims 1-2, 4-7, and 13-16 (the "Challenged Claims") of U.S. Patent No. 8,712,708 ("'708 patent," Ex. 1001) to Matti Samuli Halme, purportedly owned by WSOU Investments LLC. ("Patent Owner").

II. MANDATORY NOTICES

Real Party-in-Interest: The sole real party-in-interest is OnePlus Technology (Shenzhen) Co., Ltd.

Related Matters: The '708 patent has been asserted against Petitioner in *WSOU Investments LLC d/b/a Brazos Licensing and Development*, Civil Action No. 6:20-cv-952 (WDTX). The suit was filed on October 14, 2020. The Petitioner is aware of four additional lawsuits between the parties, involving other patents: *WSOU Investments LLC d/b/a Brazos Licensing and Development v. Oneplus Technology (Shenzhen) Co., Ltd.*, 6-20-cv-00953 (WDTX); *WSOU Investments LLC v. Oneplus Technology (Shenzhen) Co., Ltd.*, 6-20-cv-00958 (WDTX)[1]; *WSOU Investments LLC d/b/a Brazos Licensing and Development v. Oneplus Technology (Shenzhen) Co., Ltd.*, 6-20-cv-00952 (WDTX); *WSOU Investments*

[1] This is not a typo on the part of Petitioner.

LLC d/b/a Brazos Licensing and Development v. Oneplus Technology (Shenzhen) Co., Ltd., 6-20-cv-00956 (WDTX). All of those suits were filed on October 14, 2020. To the best of Petitioner's knowledge, the '708 Patent has not been asserted against other parties.

Lead Counsel: Dion Bregman (Reg. No. 45,645); Back-up Counsel: Michael J. Lyons (Reg. No. 37,386).

Service: Service of any documents may be made at Morgan, Lewis & Bockius LLP, 1400 Page Mill Road, Palo Alto, CA, 94304 (Telephone: 650.843.4000; Fax: 650.843.4001).

Petitioner consents to e-mail service at: OnePlusIPRs@morganlewis.com

III. IDENTIFICATION OF CLAIMS AND GROUNDS

'708 Patent: This patent was filed on **October 25, 2010**. It is subject to the pre-AIA provisions of 35 U.S.C. § 102, referenced below.

Kao: U.S. Patent No. 8,319,479 titled "Method of estimating battery recharge time and related device" to Chin-Hsing Kao, Chun-Ming Chen, and Tien-Chung Tso. ("Kao," Ex. 1003), filed **March 23, 2010** and granted November 27, 2012, and thus is prior art under § 102(e)(1).

Battery Charging Specification: The USB *Battery Charging Specification* version 1.0 by the USB Implementers Forum ("USB Specification," Ex. 1004) was

published and publicly available at least as early as on **March 08, 2007** and, as such, is prior art under § 102(b). Evidence regarding public accessibility includes (i) WIPO Patent Pub. No. WO 2008/120044 A1 ("WIPO Publication," Ex. 1007), which cites to the USB Specification; (ii) M. Buchanan, "Giz Explains: An Illustrated Guide to Every Stupid Cable You Need," *Gizmodo*, July 30, 2008 ("Gizmodo article," Ex. 1008), which cites and includes a link to the USB Specification; and (iii) the declarations of M. Buchanan (*Gizmodo* article author) (Ex. 1011) and T. Remple (former USB-IF Battery Charging workgroup Chair) (Ex. 1013). An affidavit from D. Hall (Records Request Processor at the Internet Archive) (Ex. 1016) further confirms the public availability and accessibility of the USB Specification on the WWW at least as early as August 5, 2008.

Maxim: The Maxim ("Dallas Semiconductor") Application Note #3383 ("Maxim," Ex. 1015), published on September 7, 2006, and is thus prior art under § 102(b), describes certain Maxim battery "fuel-gauge" products, and explains their functions. Evidence regarding public accessibility, filed herewith, includes a declaration from D. Hall (Records Request Processor at the Internet Archive) (Ex. 1016) certifying that the HTML and PDF versions of Maxim were captured from Maxim's website on October 17, 2006. As the chip is still sold, both HTML and PDF forms of the original dated Note are available on Maxim's website.

Petitioner requests that the Board find each of the Challenged Claims invalid

under the grounds below:

Ground 1: Claims 1, 4, 7, and 14-15 are unpatentable under § 102 as anticipated by Kao;

Ground 2: Claims 1-2, 4-7, and 13-16 are unpatentable under § 103 as obvious over Kao in view of the USB Specification.

Ground 3: Claims 1-2, 4-7, and 13-16 are unpatentable under § 103 as obvious over Kao in view of the USB Specification and MAXIM.

IV. CERTIFICATION AND FEES

Petitioner certifies the '708 patent is available for IPR and that Petitioner is not barred or estopped from requesting this IPR on the grounds identified herein.

Any additional fees for this IPR may be charged to Deposit Account No. 50-0310 (Order No. 122130-8001).

V. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION TO DENY INSTITUTION UNDER 35 U.S.C. § 314(A)

To the extent Patent Owner argues that the Board should exercise its discretion by denying institution under §314(a), such an argument would be unavailing. As of the filing of this Petition, trial has is set for February 6, 2023, approximately 18 months out. Accordingly, the Board would seek "to balance considerations such as system efficiency, fairness, and patent quality." *Apple Inc. v. Fintiv Inc.*, IPR2020-00019, Paper 11 at 5 (PTAB Mar. 20, 2020) (precedential),

Paper 11 at 5 (collecting cases). Here, that balance would tip strongly in favor of institution. *Fintiv* sets forth six non-exclusive factors (*id.* at 5-6):

A. Whether The Court Granted A Stay Or Evidence Exists That One May Be Granted If A Proceeding Is Instituted

Neither party has requested a stay in the District Court. It is unknown and entirely speculative at this point whether the case could be stayed or the trial date may be otherwise delayed. However, Patent Owner has asserted patents against Petitioner in ***five* co-pending litigations** in the same District Court. Therefore, the District Court will likely need to stage or delay portions of these cases leading up to trial. Institution would increase the likelihood of at least a partial stay or delay of the case involving this patent.

Staying the corresponding litigation aligns with Congressional intent. *See IOENGINE, LLC v. PayPal Holdings, Inc.*, Nos. 18-452-WCB; 18-826-WCB, 2019 WL 3943058, at *3-4 (D. Del. Aug. 21, 2019) ("Congress intended for district courts to be liberal in granting stays"; liberal stay policy applies to both IPR and CMB proceedings); 157 Cong. Rec. S1363 (daily ed. Mar. 8, 2011) (statement of Sen. Schumer) (Congress intended to place "a very heavy thumb on the scale in favor of a stay being granted"); *NFC Tech.*, 2015 WL 1069111, at *7 ("[A]fter the PTAB has instituted review proceedings, the parallel district court litigation ordinarily should be stayed.").

Petitioner submits that the Board should decline to speculate as to how the District Court might rule on a potential stay request or otherwise how the District Court might choose to stage or manage proceedings involving five separate actions, where a subset of patents in these cases are being (or will be) challenged by IPR. It would not be appropriate for the Board to try to predict whether a particular district court judge will stay a particular case. *See Sand Revolution II, LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB June 16, 2020) ("In the absence of specific evidence, we will not attempt to predict how the district court in the related district court litigation will proceed because the court may determine whether or not to stay any individual case, including the related one, based on a variety of circumstances and facts beyond our control and to which the Board is not privy."). It is enough that a stay is legally available and no circumstances would prevent a stay.

As such, this factor is neutral at this time.

B. <u>Proximity Of The Court's Trial Date To The Board's Projected Statutory Deadline For A Final Written Decision</u>

The district court case involving this challenged patent is in its early stage. The Petitioner-Defendant just answered the Complaint on July 22, 2021.[2] Due to

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[2] Federal Circuit mandamus review of Petitioner's motion to dismiss for lack of

the COVID-19 pandemic, Petitioner understands that service under the Hague Convention, the only option Petitioner-Defendant contends would potentially be available to Patent Owner, would take at least a year, if not multiple years. Accordingly, trial is unlikely to occur prior to 2023.

While the Court has assigned a trial date of February 6, 2023, the same trial date has been assigned for multiple other cases pending before the ***same judge***. *See* Ex. 1017. It is highly unlikely that more than two or three of Patent Owner's cases could be combined before the same judge in a single trial, and if one were to be transferred to another judicial officer, that would add additional delay and uncertainty to the trial date. Further, as the majority of the other cases were filed before the case involving this patent, it is likely that the challenged patent would not be part of the first trial.

However, even if trial were to occur in February 2023, it would occur at approximately the same time as the deadline for a final written decision. But the District Court likely would not yet have issued its rulings on the parties' post-trial motions, which could take several months. Thus, even under this scenario, the District Court proceedings would not be concluded first, and a final written decision could obviate or simplify proceedings on this patent. As the Board has

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personal jurisdiction and service is pending.

recently reasoned: "we need not speculate as to when a trial in the related district court proceeding will occur. Given the minimal amount of overlap between the currently scheduled trial and the deadline for a decision in this proceeding—a few weeks—this factor strongly weighs in favor of instituting *inter partes* review." *MED-EL v. Advanced Bionics*, IPR2020-00190, Paper 15 at 12 (PTAB June 3, 2020) (declining to exercise discretion under 314(a) where trial date was set before deadline for final written decision).

Accordingly, this factor weighs against discretionary denial.

C. Investment in The Parallel Proceeding By The Court And The Parties

The Petitioner-Defendant just answered the Complaint on July 23rd. Claim construction has just begun in the District Court, with a *Markman* hearing tentatively scheduled for October 28, 2021. Neither fact nor expert discovery have begun. By the time of the institution deadline, it is unclear whether the District Court is expected to have issued claim construction rulings. The District Court is unlikely to have considered any dispositive issues in the case, nor any invalidity issues based on the prior art. Accordingly, institution would save substantial resources of the parties and the Court, as the District Court could rely upon the PTAB for claim construction, and may determine whether the case should be

stayed to avoid duplicating effort already expended by the PTAB. This factor weighs against discretionary denial.

D. Overlap Between Issues Raised in the Petition and in the Parallel Proceeding

This Petition challenges a claim (claim 13) that was not asserted in the District Court case. For this reason alone, this factor weighs against discretionary denial. Moreover, although the invalidity contentions served in the District Court proceeding include the prior art cited in this Petition, there are additional references in the invalidity contentions. The Board has also found that "overlap [between the invalidity issues in district court and the IPR] may inure to the district court's benefit, however, by simplifying issues for trial should we reach our determination on the challenges raised in the Petition before trial." *MED-EL v. Sonova AG*, IPR2020-00176, Paper 13 at 15 (PTAB June 3, 2020) (declining to exercise discretion under 314(a) where trial date was set before deadline for final written decision). In addition, it is uncertain whether the District Court would have the resources to handle invalidity analyses across the five cases without disruption to its docket. It is far more efficient for the Board to handle some of that workload. This factor weighs against discretionary denial.

E. Whether The Petitioner And The Defendant In The Parallel Proceeding Are The Same Party

Petitioner and the Defendant in the parallel proceeding are the same. Although this factor arguably weighs in favor of discretionary denial, this interpretation of the factor has been questioned by the Board. *See Cisco v. Ramot*, IPR2020-00122, Paper 15 at 10 (dissent).

F. Other Circumstances That Impact The Board's Exercise Of Discretion, Including The Merits

The merits of this Petition are strong and distinguish it from instances where the Board applied discretionary denials. *See NHK Spring Co. v. Intri-Plex Technologies, Inc.*, IPR2018-00752, Paper 8 (denying institution under a merits-based discussion of § 325(d), and applying § 314(a) as an additional factor); *Apple v Fintiv*, IPR2020-00019, Paper 15 at 17 ("based on our own preliminary assessment of the merits of some challenges presented in the Petition, we view Petitioner's arguments as containing some weaknesses. On balance, these facts, when viewed holistically, lead us to determine that efficiency is best served by denying institution.").

Moreover, unlike in *Fintiv*, Patent Owner has asserted five patents across five separate cases. It is unreasonable to leave the District Court to consider summary judgment motions on invalidity and/or non-infringement for all of these patents. Here, it is ***far more efficient*** for the Board to address the patentability

grounds in this Petition. Moreover, the Board's technically trained judges are well suited to assess the patentability grounds presented in this Petition. This factor weighs strongly against discretionary denial.

For the foregoing reasons, instituting IPR would be an efficient use of Board resources and by far the most efficient division of judicial resources (relative to the District Court) for overall system efficiency, fairness, and patent quality.

VI. BACKGROUND

A. The '708 Patent

The '708 patent describes estimating remaining charging time of a rechargeable battery. Ex. 1001 Abstract, 1:30-32. It explains that rapid charging of batteries involves multiple "phases," to permit maximum current during the majority of a battery's charging cycle, while ensuring that charging is tempered (but voltage is maintained) during the end of the charging cycle. These well-known phases are known as the "constant current phase" and "constant voltage phase" of charging. *Id.* As their names imply, during the "constant current phase" (yellow), the current is kept constant, while the voltage may vary (here, increasing), and during the "constant voltage stage" (orange), the voltage is kept constant but current may vary (here, decreasing). This is illustrated below:

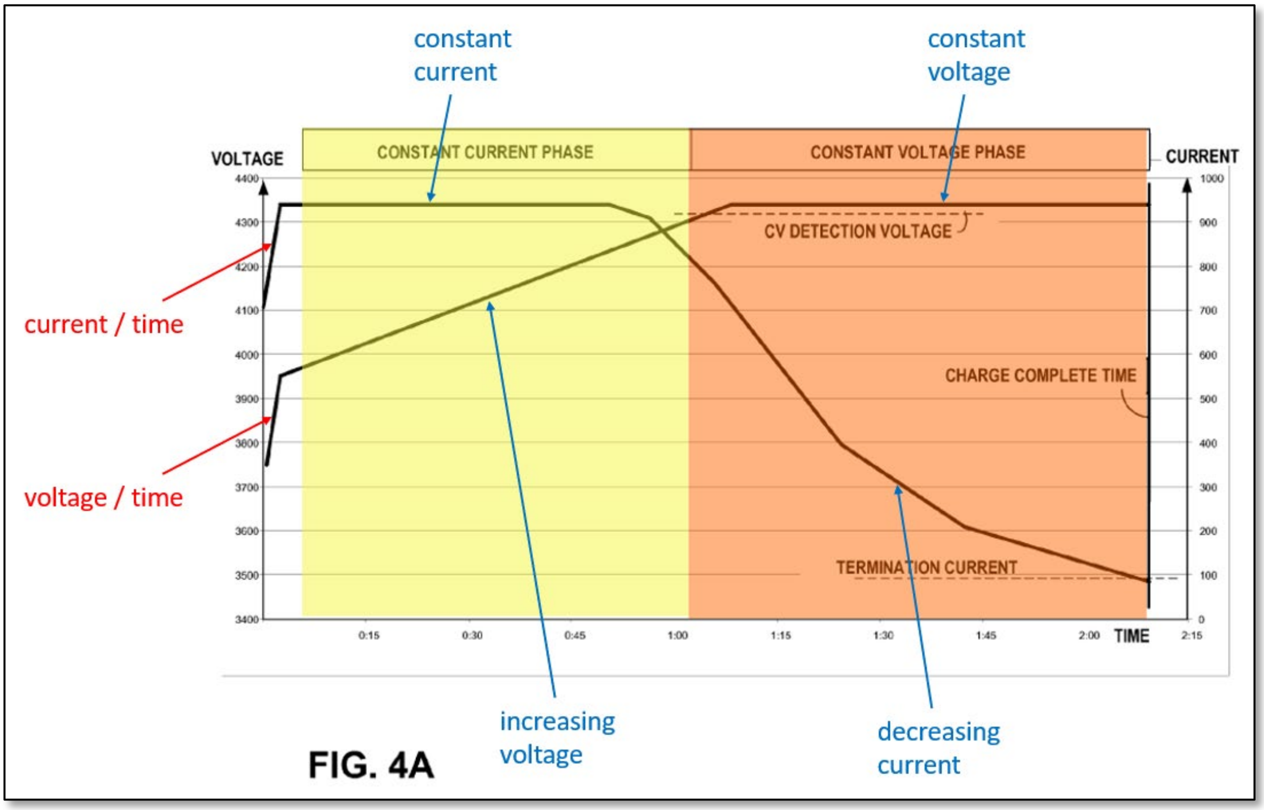


FIG. 4A

Ex. 1001 Fig. 4A[3]. A system can estimate the amount of time remaining for a battery to be charged by determining the battery's current state-of-charge, including which phase it is in, the approximate time remaining in each phase, and data about the battery. Ex. 1001 2:1-11. The amount of time (and the percentage of the charging cycle) that a given battery spends in each phase varies based on various factors, such as the characteristics of the battery or the type of charger. Accordingly, such characteristics of the battery are stored on the device and/or

[3] All emphasis, colorization, and/or annotations added throughout, unless otherwise noted.

battery to be used to accurately predict the remaining charging time. Ex. 1001 10:51-57 ("Step 406: determining whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics.).

During prosecution, the majority of the claims of the '708 patent application were rejected under 35 U.S.C. §101 as being directed to non-patentable subject matter, as well as being anticipated under 35 U.S.C. §102 by JP407274408A to Motomiya. Ex. 1002, p113. The Examiner explained that Motomiya disclosed:

> detecting an availability of a charger adapter ('408, detection of signals to ref. 16); determining whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics and constant voltage phase charging characteristics ('408, abstract); calculating a time remaining to charge in the constant current phase based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase ('408, abstract, t1); and calculating a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase ('408, abstract, t2).

Id., p113-114.

Pending Claim 11 was objected to, but indicated to be allowable. *Id.*, p117. Claim 11 required that the characteristics comprise a battery stored-charge value "based on **monitored tracking** of battery charging and discharging." *See id.*, p24. This is otherwise known as Coulomb counting. The Applicant amended the independent claims to incorporate the limitations of allowable Claim 11 and intermediate dependent Claim 9. *Id.*, pp139-144. The amended claims were then allowed. *Id.*, pp151-152. No reasons for allowance were given. *Id.*

B. The Prior Art

1. Kao

The Examiner was not aware of Kao (Ex. 1003) during prosecution. Just like the '708 patent, Kao discloses a system that, when a charger is connected to the battery; the system determines whether the battery is in a constant-current or constant-voltage phase of charging; determines the amount remaining in each phase, as applicable; and then provides an estimate of the remaining time until fully charged. As shown below, Kao discloses the exact same phases, functioning in the exact same manner, as the '708 patent:

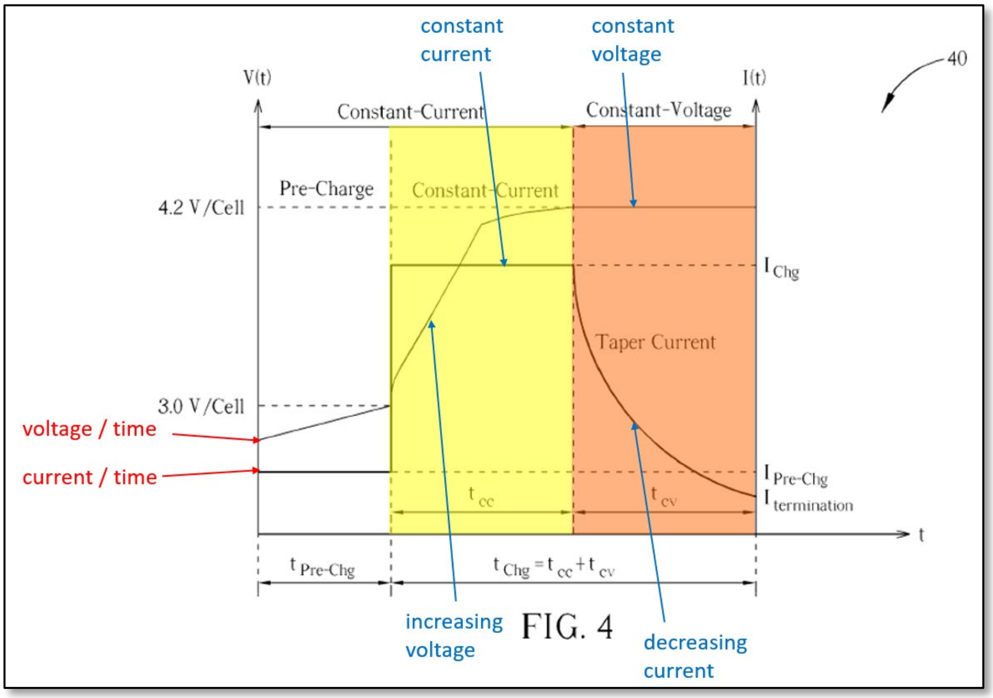
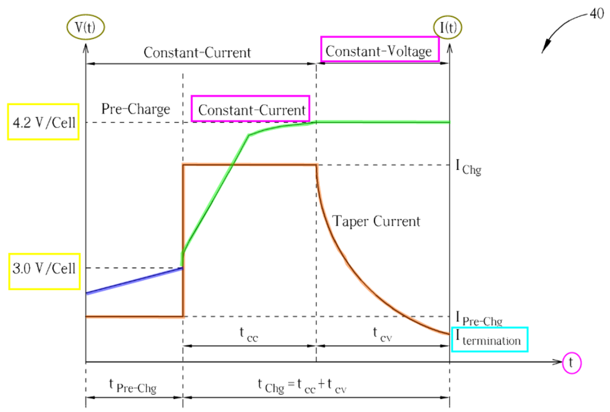
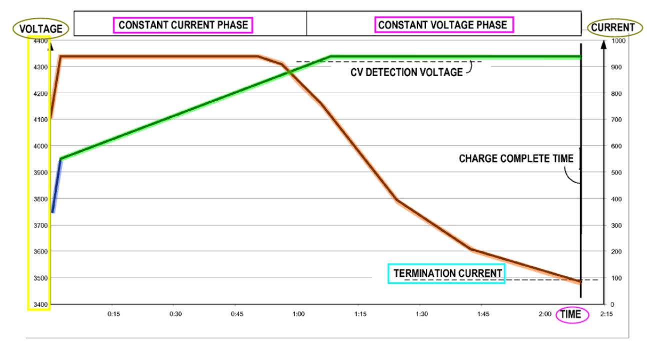


FIG. 4

Ex. 1003 Fig. 4. Like the ’708 patent, Kao discloses determining the remaining time to charge using stored-charge battery “characteristics” (which it calls “parameters”). As discussed with respect to Limitation 1[B], below, these are the same characteristics used in the ’708 patent. *See* §IX.A.1; Ex. 1005 ¶0031. Further, Kao expressly discloses using parameters that are determined from monitoring battery usage. Ex. 1003 3:58-65; Fig. 3. Accordingly, Kao discloses the exact same system and method as that claimed in the ’708 patent. This is clear when the figures of Kao and the ’708 patent are viewed side-by-side:

 FIG. 4	 FIG. 4A
Ex. 1003, Fig. 4.	Ex. 1001, Fig. 4A

In particular, and as explained in detail below with respect to the Ground #1 analysis, Kao discloses each element of each of the independent claims of the ’708 patent, as well as multiple dependent claims. In view of Kao, the remaining claims would have been obvious to a PHOSITA, as well as when combined with the other identified prior art references in Grounds 2 and 3.

2. The USB Battery Charging Specification

The USB Battery Charging Specification v1.0 (Ex. 1004) (“USB-Specification”) was publicly released by the USB Implementers Forum on March 8, 2007. The Wayback Machine captured a copy of the specification, as well as the overall USB specifications page which links to it, in November 2008. *See* Ex. 1016 (declaration). The USB Implementers Forum subsequently released v1.1 of the specification in February 2009. Ex. 1013; *see* Ex. 1009. At least versions 1.0

and 1.1 are §102(b) prior art to the '708 patent. By the late 2000's, the USB standard described in these specifications had become the pre-dominant specification for coupling mobile devices to chargers and computers. In fact, in July 2008, the popular Internet website *Gizmodo* wrote an article referencing the USB-Specification, noting that "USB 2.0 adds in the Battery Charging specification 1.0, which allows for dedicated charging and other power goodness," explaining that "[i]t plugs everything from your iPod to your digital camera into a computer, or whatever else," and provided a link to the USB-Specification on USB.org. Ex. 1008; *see* Ex. 1011 (Buchanan declaration).

While the '708 patent does not cite to the USB-Specification, many of its examples are the same as in the USB-Specification, providing a strong indication that the '708's inventor was familiar with the standard (despite not disclosing it to the USPTO). *See* §IX.B; Ex. 1005 ¶0034, ¶¶0182-186. Indeed, the '708 patent describes multiple categories of USB chargers that are recited and described in detail in the USB-Specification. Ex. 1001 8:20-32; Ex. 1009, pp1-3, pp8-12. A published PCT application, WO2008120044, filed on March 29, 2007, by the original Assignee of the '708 patent, Nokia, specifically refers to the USB-Specification, noting that "requirements for battery charging and for charger detection are described in the **USB battery charging specification 1.0**." Ex. 1007 1:29-30.

The USB-Specification expressly discloses detecting USB chargers, including the type of USB charger (*e.g.*, dedicated chargers, hosts, etc.) and varying the charging profiles for each type of charger. As such, to the extent that the Patent Owner asserts that Kao does not explicitly disclose "detecting…a charger adapter," this was well known at the time, as disclosed in the USB-Specification, which discloses detecting the charger category and using that category to configure the charging and improve the accuracy of the estimates recited in certain dependent claims. Ex. 1008 §3.

3. MAXIM

Maxim (Ex. 1015) is a 2006 Note describing a Maxim (Dallas Semiconductor) Coulomb counter chip, and explains the functions of a Coulomb counter. A PHOSITA at the relevant time would have known what a Coulomb counter does, and MAXIM confirms this knowledge. Ex. 1005 ¶0037. The Note was posted on Maxim's website at least as early as September 2006, and was captured by the Internet Archive's Wayback Machine at least as early as October 2006, and is §102(b) art to the '708 Patent.

VII. LEVEL OF SKILL

A person of ordinary skill in the art ("PHOSITA") at the time of the alleged invention would have had at least an undergraduate degree in electrical engineering, or equivalent education, and two years of work experience in the field

of battery charging systems, or equivalent work experience or training. Ex. 1005 ¶0038.

VIII. CLAIM CONSTRUCTION

Claims are given the same construction as they are given in district court pursuant to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Petitioner proposes the following term for construction.

A. "detect[ing]…an availability of a charger adapter"

Claim 1 recites "detecting, by an apparatus, an availability of a charger adapter." Similarly, claims 14 and 15 recite "detecting an availability of a charger adapter" and "detect an availability of a charger adapter," respectively. Ex. 1001 Cls. 1, 14-15. The charge adapter 50 of the '708 patent is shown below in yellow:

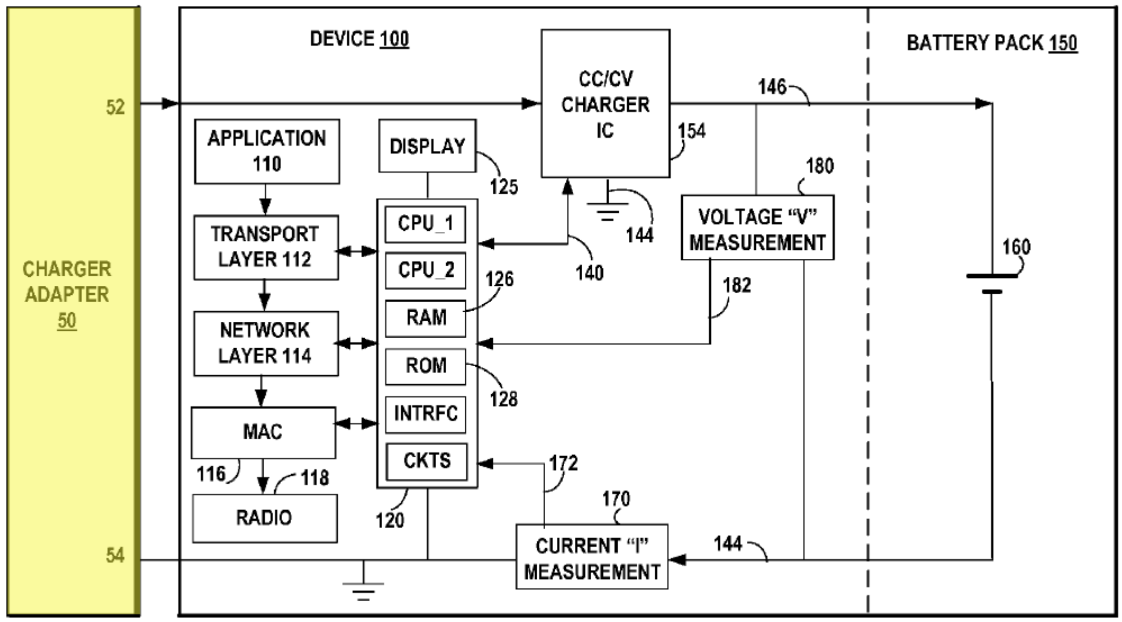


FIG. 1A

Ex. 1001 Fig. 1A.

Apart from requiring that its "availability" be "detect[ed]," the term "adapter" is not recited elsewhere in the independent claims. Rather, the charger adapter is only referred to later in claims 5 and 6, each of which depend from claim 1. The specification and figures say nothing about "detecting…availability of a charger adapter" beyond repeating the language in the claims, "[e]xample embodiments of the invention include an apparatus, comprising: **means for detecting an availability of a charger adapter**," and Figure 5. Ex. 1001 11:10-12, 10:50; Fig. 5.

Dependent claims 5 and 6 recite "identifying ***the correct category of*** the

charger adapter **after** detecting its availability." Ex. 1001 Cls. 5-6. The specification teaches that the "category of charger adapter…may be identified **soon *after*** the charging cable…has been connected" and the "initial charge current is specific for each…category of charger adapter." *Id.* 8:20-34. The specification and these dependent claims confirm that "detecting an availability of a charger adapter" is distinct from identifying the category of the charger adapter. Since the "detecting" is directed merely to the "*availability* of a charger adapter," and not its category, it can only be understood as detecting the presence of available current or voltage on an input line. Accordingly, the term should be interpreted to mean "**detecting charging energy (*e.g.*, voltage and/or current) from an adapter**." Ex. 1005 ¶¶0042-044.

IX. ARGUMENT

A. GROUND #1: Claims 1, 4, 7, and 14-15 are anticipated by Kao

1. Claim 1[4]

Preamble [P]

Generally, the preamble is not limiting. To the extent the preamble is a limitation of the claim, Kao discloses "a **method**." Ex. 1005 ¶0053. In particular,

[4] An Appendix containing the full claim listing for each claim is attached.

Kao discloses that it "relates to battery chargers, and more particularly to **a method** of estimating recharging time of a rechargeable battery and a related charging device." Ex. 1003 1:7-9.

Limitation [A]

The claim requires "**detecting**, by an **apparatus**, an **availability** of **a charger adapter**," which is disclosed by Kao. Ex. 1005 ¶0054.

Kao discloses "an apparatus," as it discloses a "smart battery **device**," which is a particular type of apparatus. Ex. 1003 Abstract. Kao's "FIG. 2…is a block diagram of a smart battery device 20." *Id.*, 3:24-25. Accordingly, Kao discloses "an apparatus." Ex. 1005 ¶0055.

As discussed above in §VIII.A, "detecting...an availability of a charger adapter" should be construed as "**detecting charging energy (*e.g.*, voltage and/or current) from an adapter**." This is also disclosed by Kao. As shown below, Kao discloses that it "comprise[s]…an external **adapter 220**" (yellow):

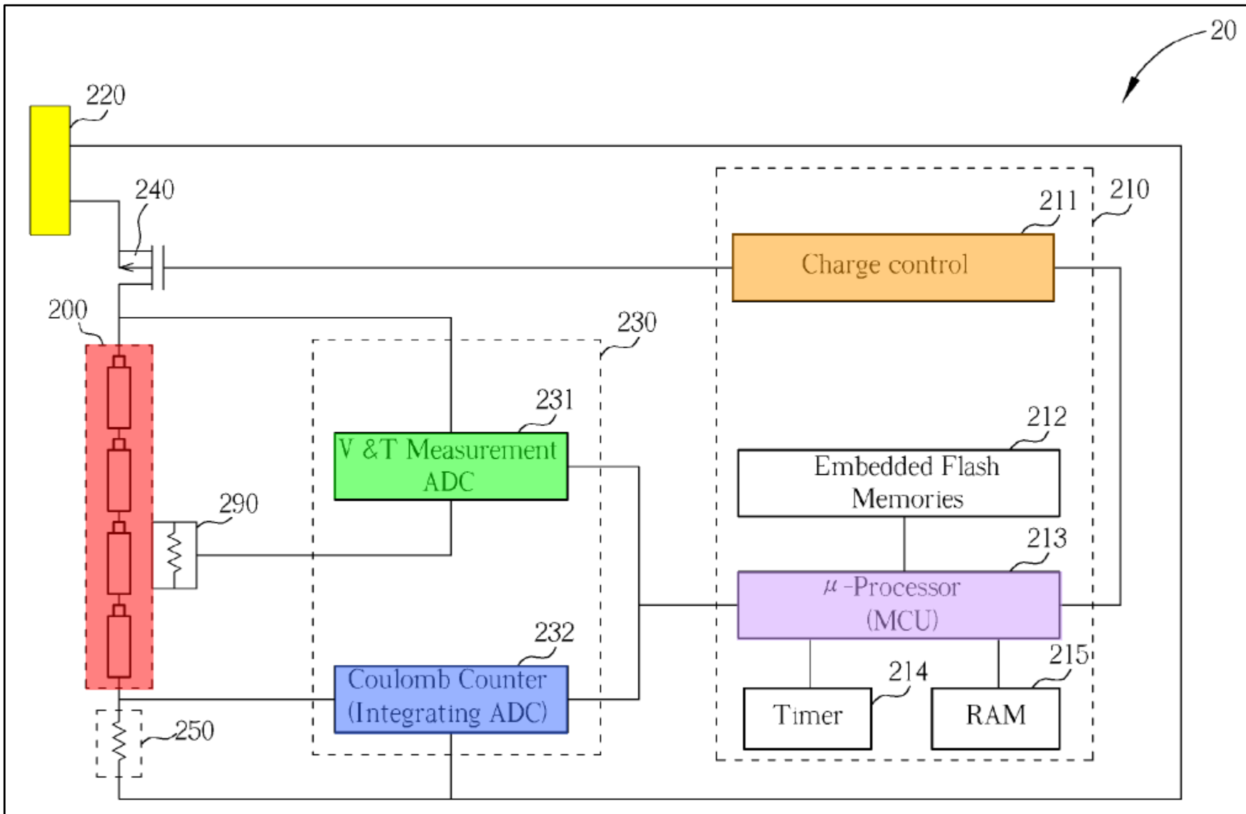


FIG. 2

Ex. 1003 at 3:24-29; Fig. 2. Kao further discloses ***how*** it uses its charging adapter. For example, Kao discloses that the adapter 220 is **selectively connected** to "a **battery** pack 200" (red) **through a switch** controlled by "**charge** control circuit 211" (orange) to charge the battery pack. Ex. 1003 3:39-45. Kao's "charge control circuit" detects the charger and turns on the switch. Ex. 1005 ¶0060.

Kao also teaches that before charging commences, there is a "pre-charge" stage [yellow, below], where pre-charging current $I_{Pre\text{-}Chg}$ [orange, below] [is] applied to the battery…until voltage…reaches a pre-charge voltage," at which point charging begins. Ex. 1003 4:50-54.

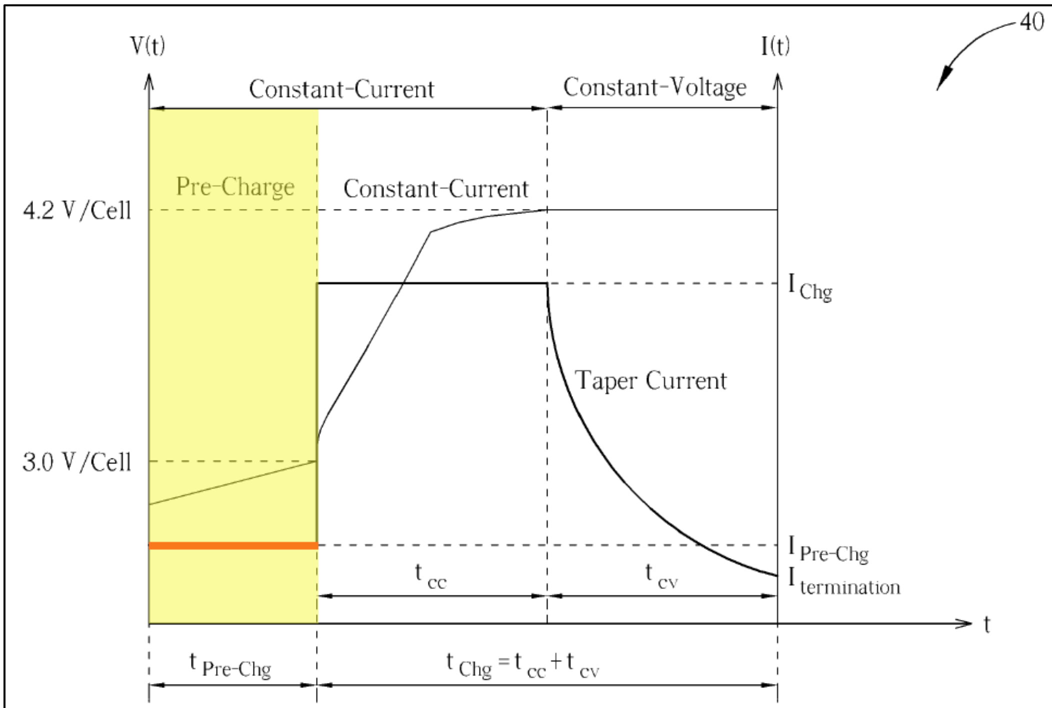


FIG. 4

Id. Fig. 4. Kao thus discloses detecting the $I_{Pre\text{-}Chg}$ current from its charger adapter 220, confirming that the device detects an adapter by detecting current from the adapter.

Further, Kao teaches that a "battery management IC…may…be electrically connected to…the current sensing resistor…for detecting [an] overcurrent event," again confirming it detects current from the adapter, *i.e.*, detects availability of a charger adapter. Ex. 1003 2:1-4; Ex. 1005 ¶0062.

Additionally, Kao includes a "Coulomb Counter 232" (blue). A PHOSITA at the relevant time would have known that a Coulomb counter counts Coulombs by monitoring the current being received into (and taken from) a battery, *i.e.*,

monitoring charging and discharging of the battery. Ex. 1005 ¶0063. The Coulomb counter could not function unless Kao detects the availability of the charger adapter 220, *e.g.*, detects voltage and/or current from adapter 220 that is used to charge the batteries. Indeed, Kao specifically states that its Coulomb counter responds to **detecting "a voltage drop across [Kao's] sense resistor**," confirming it detects the presence of its charger adapter, *i.e.*, by detecting charge energy (*e.g.*, voltage) from the adapter. Ex. 1003 Cl. 2.

Kao further includes "a **voltage** and temperature measurement ADC 231" (green) "hav[ing] a[n]…input electrically connected to the battery pack 200 **for receiving a voltage level of the battery pack 200**," thus detecting voltage increases, and thus detecting the availability of adapter 220. Ex. 1003 3:46-51. The measurements from Coulomb counter 232 and/or ADC 231 are sent to Kao's microprocessor 213 (purple), which detects the presence of charger adapter 220 in order to control charging. *Id.*, 3:51-61; Ex. 1005 ¶0064.

Kao uses the "signals measured at the battery" to control its connection to the battery. *Id.* 2:34-43.

Therefore, Kao discloses "**detecting**, by an **apparatus** [*i.e.*, "smart battery device 20"], an availability [*e.g.*, determining that there is a charging energy like

voltage and/or current] of **a charger adapter** [*i.e.*, "adapter 220]."[5] Ex. 1005 ¶0065.

Limitation [B]

The claim requires "[i] **determining**, by the apparatus, whether a battery **charging point** is in **a constant current phase** or in a **constant voltage phase**, [ii] based on **pre-determined battery charging characteristics**, [iii] wherein the pre-determined battery charging characteristics comprise **constant current phase charging characteristics** and **constant voltage phase charging characteristics**." This is disclosed by Kao. Ex. 1005 ¶0066.

Kao discloses "[i] determining, by the apparatus, whether a battery charging point is in a constant current phase or in a constant voltage phase."

First, Kao discloses determining a battery's charging point. For example, Kao recites that "the microprocessor **calculates state of charge (SOC)**…according to the digital signals." Ex. 1003 Cl. 6. "As charging is performed on the battery pack 200, the microprocessor may update state of charge SOC," *i.e.*, its charging point. *Id.* 4:32-34. Kao further confirms its use of SOC, by "repeat[ing]" certain

[5] The remaining limitations are **not** contingent on detecting the availability of the adapter, nor do they reference it, but, will be treated as occurring after a charger adapter is detected.

"[s]teps…until the state of charge SOC is greater than or equal to the final state of charge SOC_f, at which point the process 30 may end." *Id.* 4:41-43. In other words, Kao repeatedly determines the SOC (a value) and continues charging until the battery is charged.

Second, Kao discloses determining whether its charging point (SOC) is in the **constant-charging phase** or **constant-current phase**. Kao specifically discloses both phases, and states that the battery transitions "from constant current charging [including orange, below] to constant voltage charging [green, below]." Ex. 1003 2:61-64. Kao further discloses that the total charging time is the "sum of the constant current charge time and the constant voltage charge time [red, below]." *Id.* 3:2-5. This is illustrated in Kao's Figure 4, repeated below:

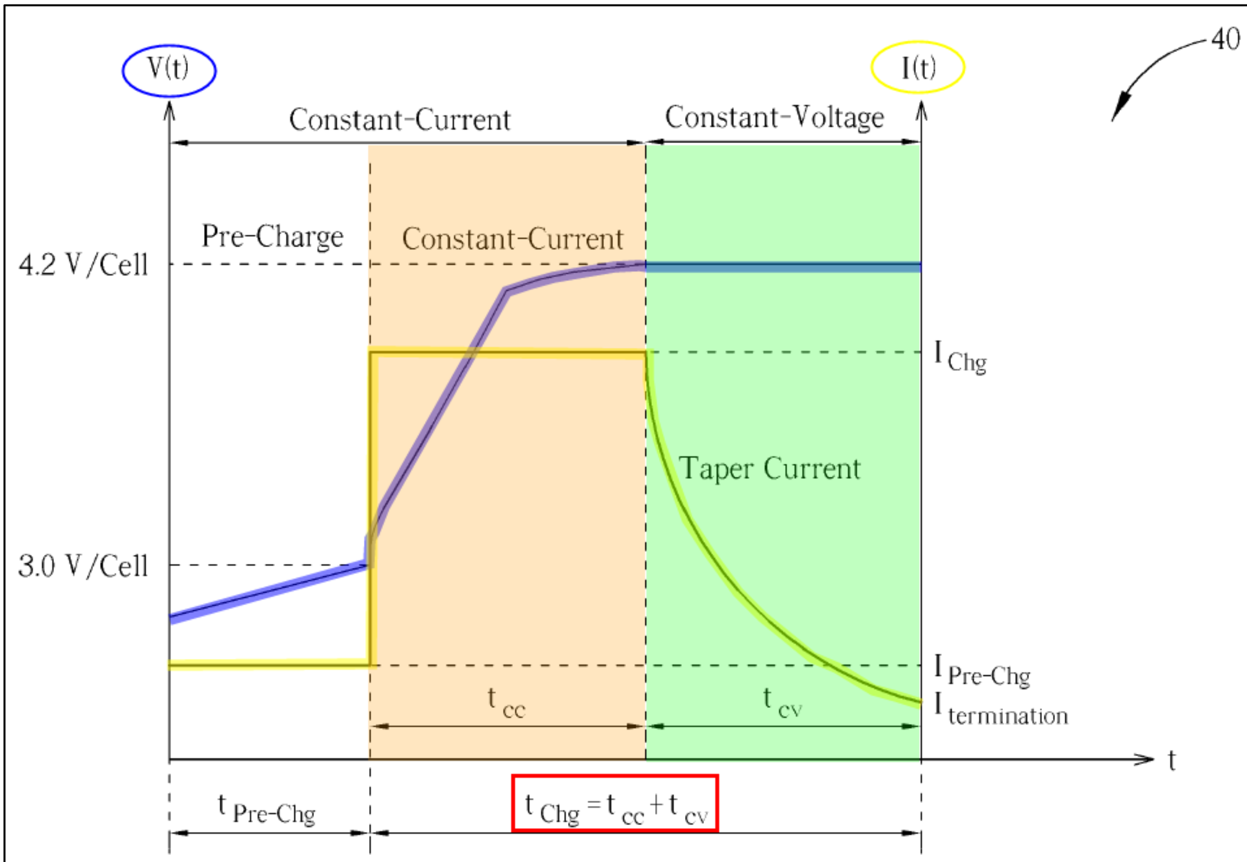


FIG. 4

Ex. 1003 Fig. 4 (showing current (yellow) and voltage (blue) plotted over time, in the constant-current (orange) and constant-voltage (green) charging phases). Kao then teaches "calculating a **transition point** from **constant current charging** to **constant voltage charging** [and] obtaining **state of charge at the transition point**," which provides the current phase of battery charging. *Id.*, 2:59-3:4. As explained below, Kao then uses this knowledge to calculate the times remaining to fully charge in each respective phases. *See id.*; Cl. 15 ("calculating constant current charge and constant voltage charge according to the transition point;

calculating constant current charge time according to the constant current charge; [and] approximating constant voltage charge time according to the constant voltage charge"); Ex. 1005 ¶¶0069-070.

Moreover, Kao teaches that "[w]hen charging the battery…pre-charging current $I_{Pre\text{-}Chg}$ may be applied…until voltage…reaches…e.g. 3.0Volts/cell…[after which] a charge current I_{Chg} [*i.e.*, the constant current] may be applied to the battery…until a charged voltage, e.g. 4.2Volts/cell, is reached." Ex. 1003 4:50-57. This confirms that Kao has determined the time spent "charging" when the constant "I_{Chg}" is "applied to the battery," when the state-of-charge is in the constant-current stage, *i.e.*, until the battery has reached a predetermined voltage. Ex. 1005 ¶0071.

Kao teaches that this charging is performed based on "pre-determined battery characteristics." Kao discloses it uses stored "parameters." Kao calls its parameters "charging **characteristics**," just like the '708 patent. Ex. 1003 3:64; *cf.* Ex. 1001 Abstract. For example, Kao's "system may receive SBS [Smart Battery System] parameters, such as Average Time To Full (ATTF), from the rechargeable battery." Ex. 1003 1:29-30; *see id.* 4:21-25 ("[T]he microprocessor may retrieve **parameters** corresponding to the charging condition from the **battery characteristic look-up tables stored** in the embedded flash memory 212."). Other examples of Kao's "charging characteristics" include: "preferred charging

condition"; "change point" (a.k.a "transition point"); "use history, firmware,…aging information"; "charge profile[s]," including "V(t)" and "I(t)"; "upper limit voltage V_{lim}"; "state of charge (SOC)" (a.k.a "amount of charge Q_{Chg}"); "charge current I_{Chg}"; "termination current $I_{termination}$"; "time threshold"; "open circuit voltage $(OCV)_i$"; "internal resistance $(R_m)_i$ of the battery"; "preferred charging time[; and] preferred charge level." *Id.* 2:44-52, 3:63-65, 4:18-27, 4:49-67, 5:12-16, 5:29-32, 5:56-58, Figure 4. As discussed below, some of these parameters/characteristics "comprise constant current phase charging characteristics," as they impact charging in the constant-current stage; some "comprise…constant voltage phase charging characteristics," as they impact charging in the constant-voltage stage; and some comprise both. Ex. 1005 ¶0072.

Just like the '708 patent, Kao's characteristics are "pre-determined," *i.e.* determined beforehand, because they have been stored in memory (*e.g.*, a "battery characteristic look-up table"), before they are used.[6] For example, Kao teaches

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[6] As distinct from "stored charge characteristics" and "battery stored charge characteristics," "pre-determined battery charging characteristics" do not need to be "stored" (*e.g.*, in memory), so long as they were determined beforehand. However, being stored in look-up table(s) confirms they are predetermined. Ex. 1005 ¶0073.

that its "memory…**stor[es]**…history data of the battery pack [and] **charge characteristics**." Ex. 1003 Cl. 2, 3:63-65. For another example, Kao teaches that its characteristics may be provided by "user input" or **pulled "from a battery characteristic look-up table** stored in a memory circuit of the smart battery device." *Id.* 2:44-50; *see id.* 4:19-25. This process is illustrated below:

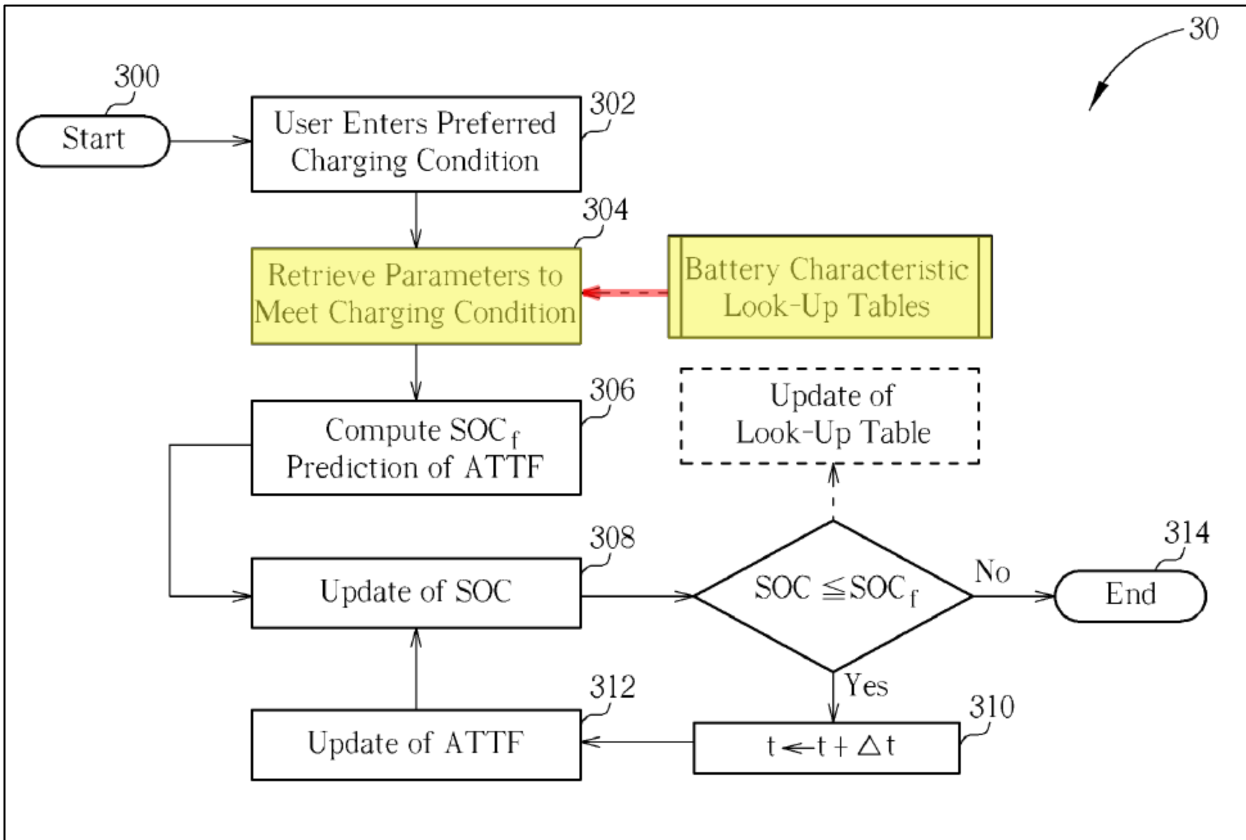

FIG. 3

Ex. 1003 Fig. 3. Kao further teaches that its characteristics "may [be] update[d]…during charging," allowing computed-characteristics to be predetermined for use in future calculations. *Id.* 4:43-48; Ex. 1005 ¶¶0073-074.

Kao teaches that its pre-determined characteristics, *i.e.*, those stored in tables, include both **constant current** phase and **constant voltage** phase **charging characteristics**. For example, Kao teaches that the characteristics pulled from "[t]he look-up tables may include parameters such as the **charge current I_{Chg},** which may affect charge time" and "upper limit voltage V_{lim} for safely charging the battery," "e.g. 4.2Volts/cell." Ex. 1003 4:25-28, 4:56-59. As is clear from Kao's Figure 4, these values are specific to the two different phases. Ex. 1005 ¶0074.

Unlike Kao, the '708 patent specification does not expressly provide examples of what it considers to be "constant current phase charging characteristics" or "constant voltage phase charging characteristics." Ex. 1005 ¶0075. However, "charging current" is ***claimed*** by the '708 patent as **both** a "constant current phase charging characteristic" and a "constant voltage phase charging characteristic." *See* Ex. 1001 Cl. 12 ("the duration of the **constant current phase** is corrected by a ratio of a **pre-measured charging current** and an actual present charging current"), Cl. 13 ("remaining charging time during the **constant voltage phase** is estimated as a mapping from charging current, using **pre-measured data** [*i.e.*, profile curve charging current], from **charging current**"). Accordingly, Kao's current (*e.g.* "I_{Chg}" in the constant-current stage and "$I_{termination}$" in the constant-voltage stage) meets both requirements for predetermined charging characteristics. Ex. 1005 ¶0075.

Kao further discloses an exemplary battery-specific characteristic "charge profile":

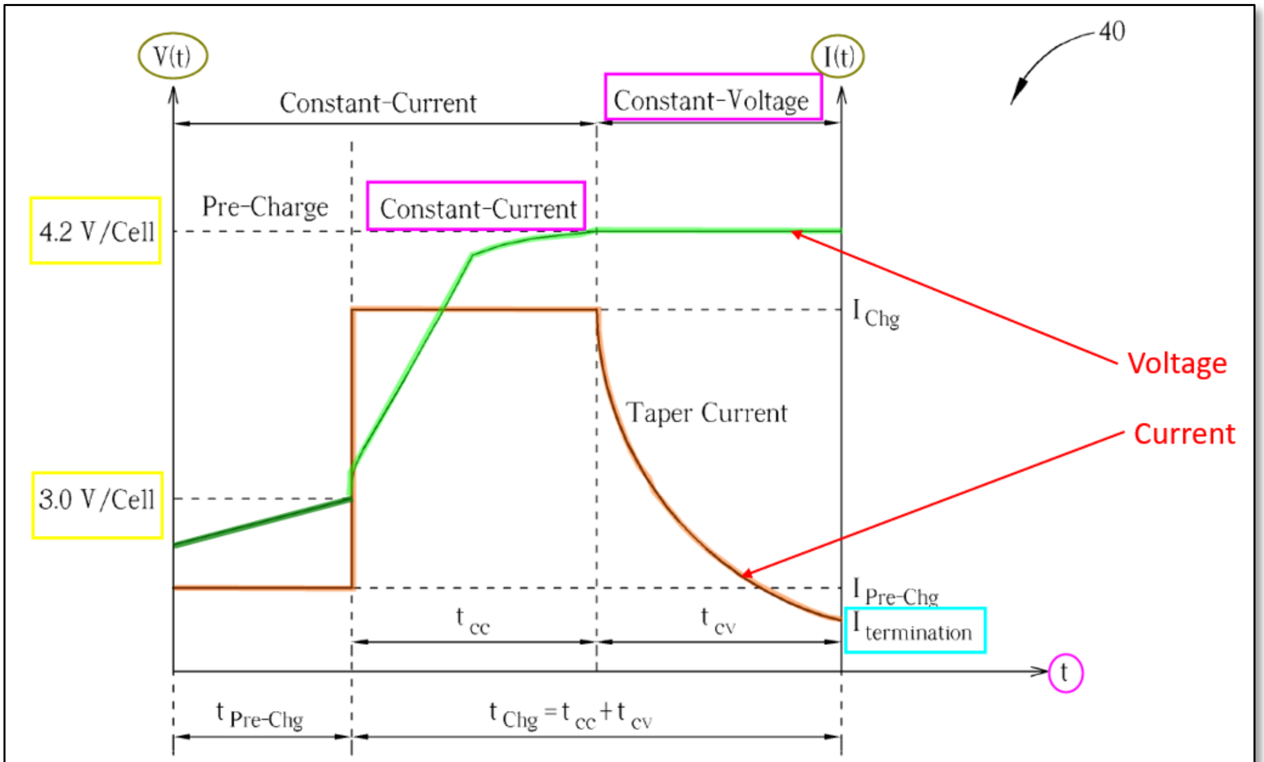

FIG. 4

Ex. 1003 Fig. 4; *see id.*, 3:20 ("FIG. 4 shows a graph illustrating a charge profile."). The "charge profile" 40 is itself a charging characteristic. Ex. 1005 ¶¶0076-077. The profile is selected based on the desired type of charging, *e.g.*, "rapid charging," "full charging," "preferred charging time or…level." Ex. 1003, 4:19-21. Kao will "retrieve parameters corresponding to the charging condition from the battery characteristic look-up tables." *Id.* 4:21-25. Kao clarifies that the "charging condition" is another word for "profile." *Id.* 4:18-19. Disclosed

parameters/characteristics in the "charge profile" include the charge current (orange), charge voltage (green), ramp-up voltage (dark-green), voltage levels in each phase (yellow), constant-current/constant-voltage phases (purple), and termination current $I_{termination}$ (cyan). Ex. 1005 ¶¶0076-077.

These are the same exemplary characteristics shown in the '708 Patent's charge profile:

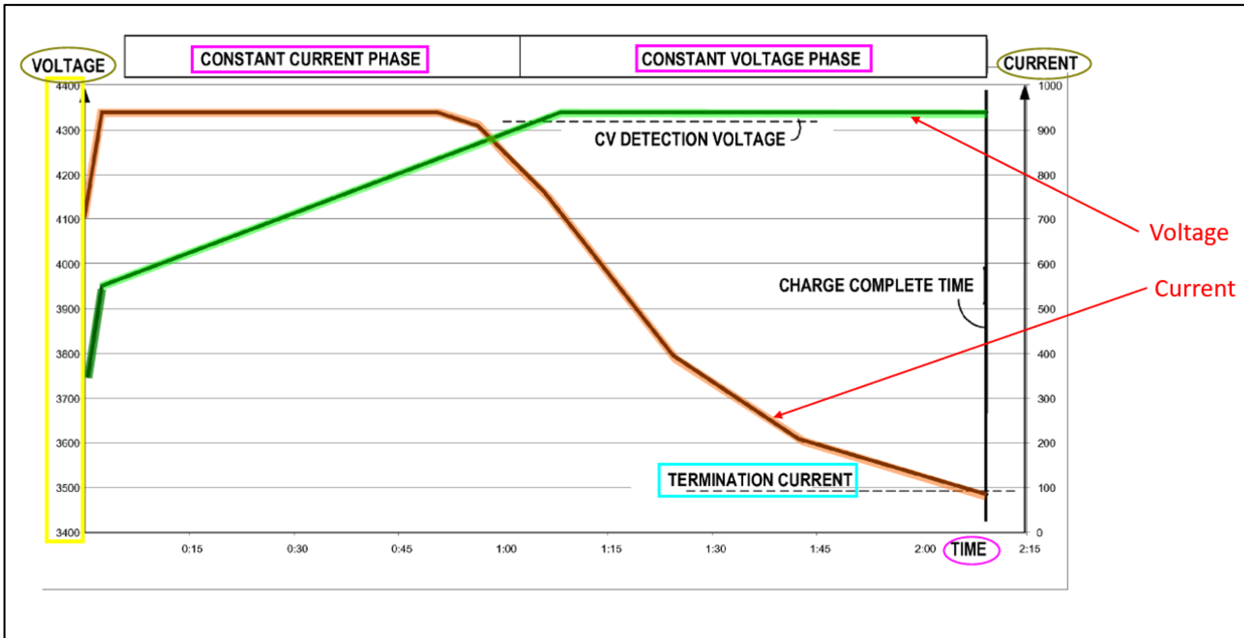

FIG. 4A

Ex. 1001 Fig. 4A (colored as above); Ex. 1005 ¶¶0076-077. Accordingly, if the '708 patent's predetermined charging characteristics are considered by the '708 patent to be constant current phase charging characteristics and/or constant voltage phase charging characteristics, they also are in Kao. Ex. 1005 ¶0078.

Accordingly, Kao's "battery charging characteristics comprise constant

current phase charging characteristics and constant voltage phase charging characteristics," and indeed, comprise the **same** ones disclosed (and claimed) in the '708 patent. Ex. 1005 ¶0079.

Therefore, Kao discloses "determining, by the apparatus, whether a battery charging point [*e.g.*, SOC] is in **a constant current phase** or in a **constant voltage phase** [*e.g.*, determining whether "SOC"≤|≥"transition point" and/or voltage at 4.2Volts/cell], based on **pre-determined battery charging characteristics** [*e.g.*, "I_{Chg}," "OCV", "profile 40"], wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics [*e.g.*, "I_{Chg}," "profile 40"] and constant voltage phase charging characteristics [*e.g.*, "OCV", "profile 40," "$I_{termination}$"]." Ex. 1005 ¶0080.

Limitation [C]

The claim requires "calculating, by the apparatus, a **time remaining to charge in the constant current phase** based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase," which is disclosed by Kao. Ex. 1005 ¶0081.

As discussed with respect to Limitation [B], Kao discloses "constant current phase charging characteristics," *e.g.*, "I_{Chg}," "profile 40." Kao further discloses that it uses those characteristics to "calculate[e]…time remaining to charge in the constant current phase." Ex. 1005 ¶0082. For example, Kao discloses "a method

of approximating average-time-to-full (ATTF) in a smart battery device compris[ing]…**calculating constant current charge time according to the constant current charge**." Ex. 1003 2:61-3:1. For example, "[t]o predict the ATTF (Step 306 [in Figure 3]), **constant current time t_{cc}** and constant voltage time t_{cv} **may be predicted**":

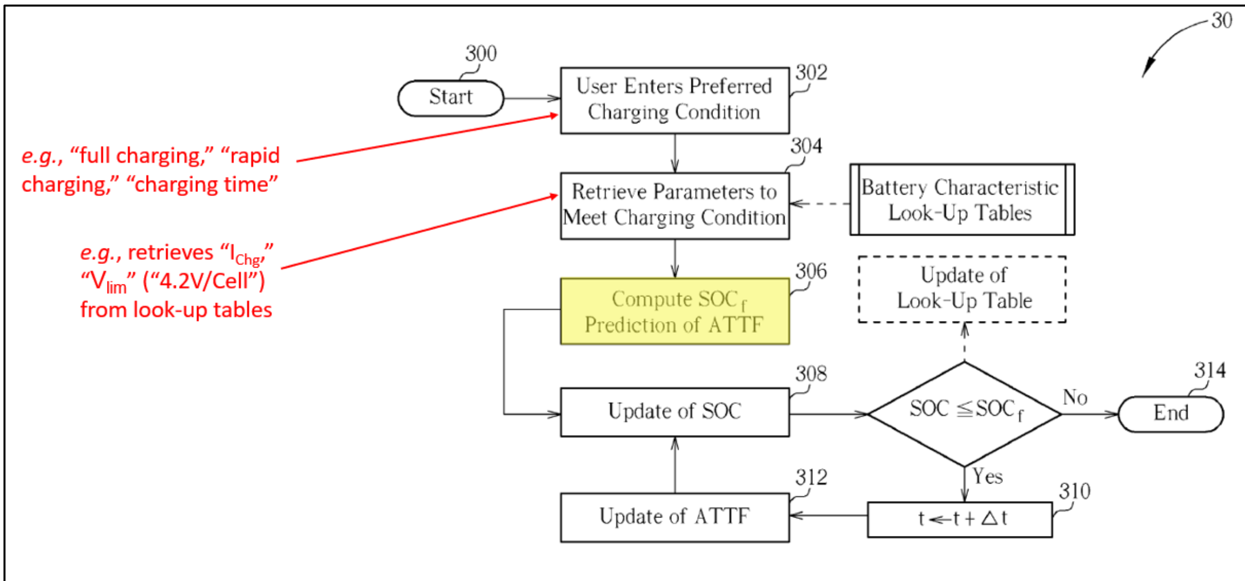

FIG. 3

Id. Fig. 3, 5:9-12. Ex. 1005 ¶0082.

Kao further teaches how this process is accomplished. Kao explains that "**constant current time t_{cc} may be predicted by determining [the] amount of charge Q_{Chg}** that may be stored in the battery pack 200 **based on a change point**, or transition point, from constant current charging to constant voltage charging." Ex. 1003 5:12-16. Kao goes on to state that "[t]he change point may be a charging percentage, e.g. 75% or 80%, corresponding to how **fully the battery pack 200 is**

charged before switching to constant voltage charging [and **b]ased on the charging percentage**, the amount of charge Q_{Chg} to be stored during constant current charging may be determined." *Id.*, 5:16-21. Thus, "**constant current time t_{cc} may then be determined** by dividing the amount of charge Q_{Chg} stored during constant current charging by the charge current I_{Chg}," which is constant during the constant-current phase. *Id.*, 5:21-24; Ex. 1005 ¶0084.

Similarly, "calculating constant current charge…[is performed] **according to the transition point**." *Id.*, 2:65-67. Thus, Kao's process is "based on…constant current phase charging characteristics." For clarity, Kao teaches that "change point" and "transition point" are the same thing, and used interchangeably. *Id.* 5:14-15; Ex. 1005 ¶0085.

The '708 patent claims do not describe any particular process for "calculating…time remaining to charge in the constant current phase." Rather, they only require that it be "based on the constant current phase charging characteristics." As discussed above, Kao's is. Ex. 1005 ¶0086.

As discussed above with respect to Limitation [B], depending on charge-level, Kao's battery may be in the constant current phase. *Id.* ¶0087; *see* Ex. 1003 2:25-3:4. Determining the time remaining in the constant-current phase, t_{cc} (red), is performed in the constant-current stage (yellow), as shown below in Figure 4, which shows the constant current (orange) and rising voltage (green) during this

phase:

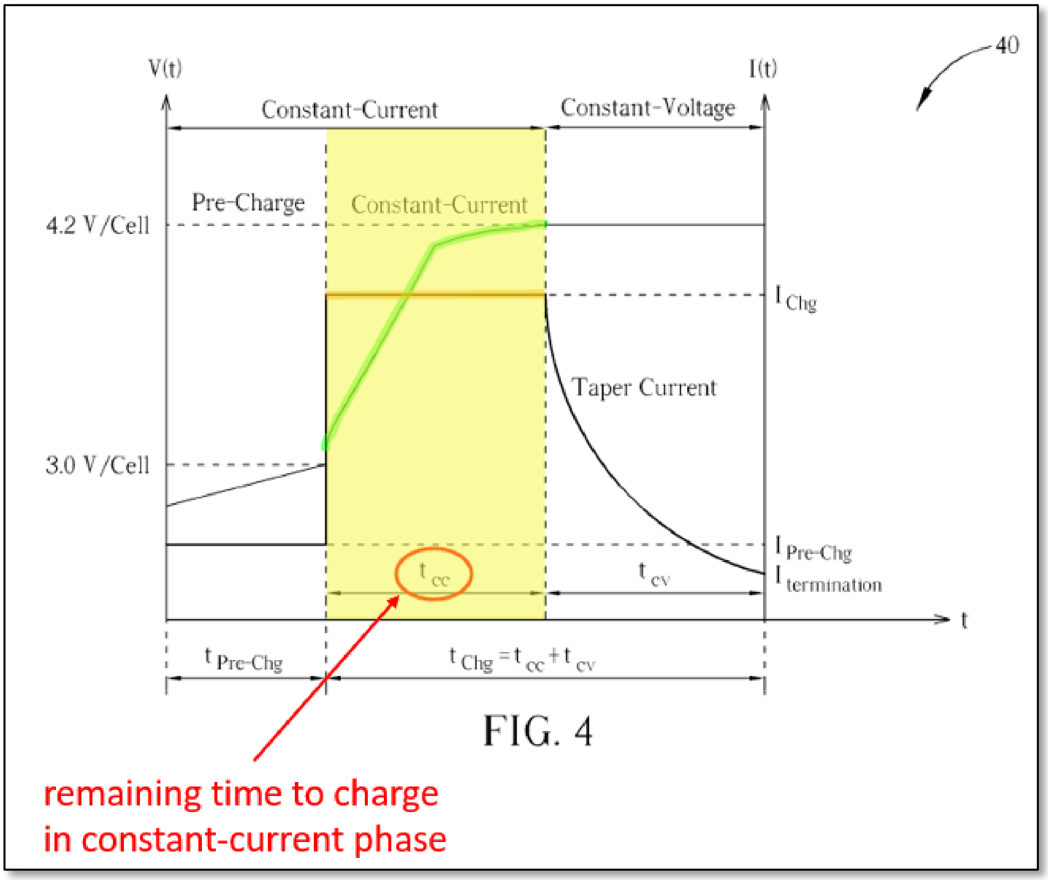

FIG. 4

Fig. 4.

Therefore, Kao discloses "calculating, by the apparatus [*e.g.*, "device"], a time remaining to charge in the constant current phase [*e.g.*, "t_{cc}"] based on the constant current phase charging characteristics [*e.g.*, "SOC," "I_{Chg}," "transition point," "Q_{Chg}," "profile"], if the battery charging point [*e.g.*, SOC] is in the constant current phase [*e.g.*, "Constant-Current" stage before the "transition point"]." Ex. 1005 ¶0088.

Limitation [D]

The claim requires "calculating, by the apparatus, a **time remaining to charge in the constant <u>voltage</u> phase** based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase," which is also disclosed by Kao. Ex. 1005 ¶0089.

As discussed with respect to Limitation [B], Kao discloses using predetermined "constant voltage phase charging characteristics." Kao stores these in lookup tables and uses them to "calculate[e]…time remaining to charge in the constant voltage phase." Ex. 1005 ¶0090. For example, Kao discloses "a method of approximating average-time-to-full (ATTF) in a smart battery device compris[ing]…**approximating constant voltage charge time according to the constant voltage charge**." *Id.* 2:61-3:1. For example, as discussed and shown with respect to Limitation [C] using flowchart Figure 3, "[t]o predict the ATTF (Step 306), constant current time t_{cc} and **constant voltage time t_{cv} may be predicted**." *See id.* Fig. 3, 5:9-12.

Kao then teaches how this process may be performed. For example, Kao explains that "constant voltage time t_{cv} may be approximated by predicting constant voltage current I_{cv} at each interval i utilized for providing an amount of charge ΔQ…[and t]o determine the constant voltage current $(I_{cv})_i$ for each interval i, an open circuit voltage $(OCV)_i$ and an internal resistance $(R_m)_i$ of the battery pack 200 may be utilized." Ex. 1003 5:24-31. "To determine interval constant

voltage time $(\Delta t_{cv})_i$ for each interval i, the amount of charge ΔQ may be divided by the constant voltage current $(I_{cv})_i$." *Id.*, 5:40-43.

Kao provides even more details about its process, teaching that "constant voltage current $(I_{cv})_i$ may be calculated by [Eq.1]" and "constant voltage time t_{cv} may be calculated as [Eq.2]," both shown below:

$(I_{CV})_i = \frac{V_{lim} - (OCV)_i}{(R_m)_i}.$	$t_{CV} = \sum_i (\Delta t_{CV})_i$

Id., 5:33-49; *see also id.*, 5:53-66 (teaching that an "iterative[]" process may also be used).

Kao clarifies that "open circuit voltage $(OCV)_i$ may be a **predetermined parameter** stored in the embedded flash memory 212." *Id.*, 5:31-33. Similarly, V_{lim} is a stored parameter in profile 40, *e.g.*, "4.2V/Cell." *Id.*, 4:56-59. Thus, OCV_i and V_{lim} are "constant voltage phase charging characteristics." Ex. 1005 ¶0093. Indeed, the "i" (interval) is only discussed by Kao when discussing the constant voltage phase. Kao confirms this, teaching that "[a]ccuracy…may be increased by increasing [the] number of intervals i utilized in predicting the **constant voltage time t_{cv}**." Ex. 1003 5:26-28, 5:50-52; Ex. 1005 ¶0093. OCV

(green), I_{cv} (orange) and V_{lim} (red) are also shown in Kao's exemplary battery "charging profile":

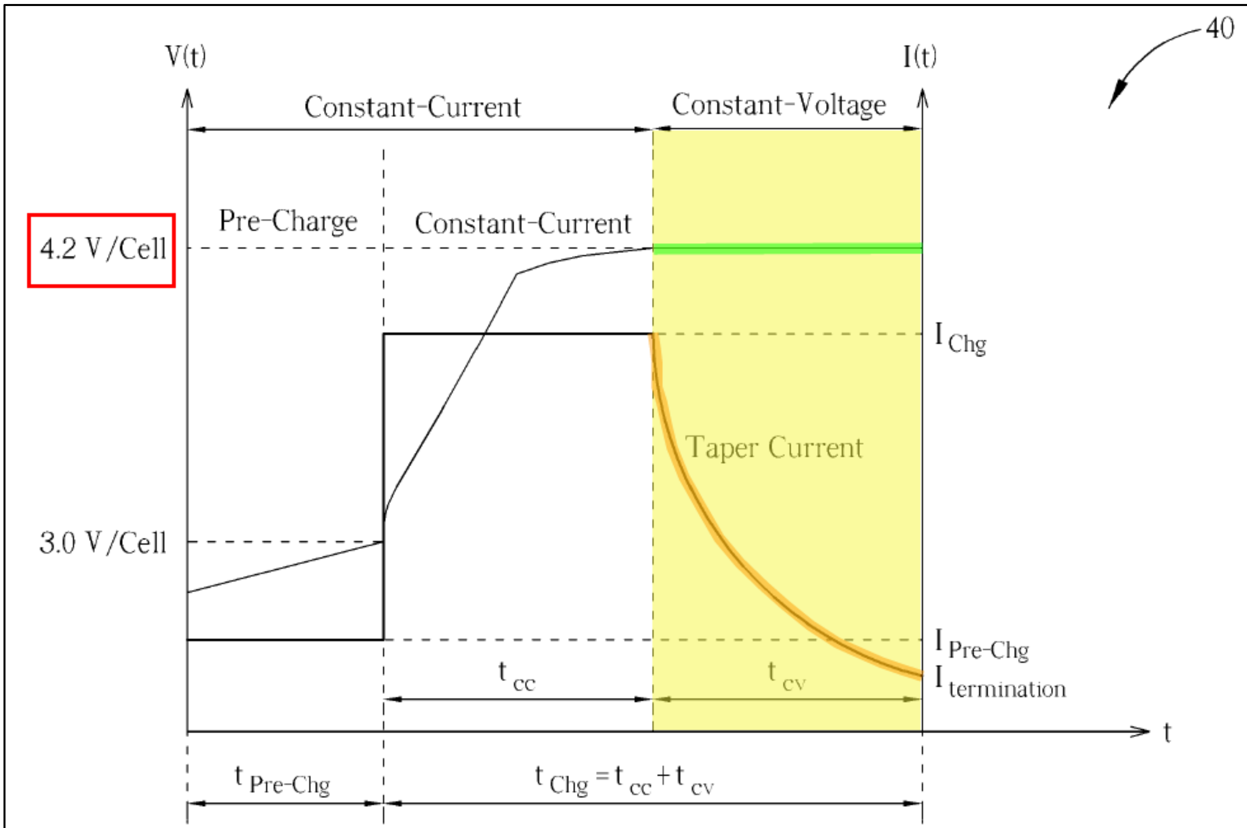

FIG. 4

Ex. 1003 Fig. 4).

The '708 patent claims do not describe any particular process for "calculating…time remaining to charge in the constant voltage phase," just that it be "based on the constant voltage phase charging characteristics." As discussed above, Kao's is. Ex. 1005 ¶0094.

Kao's process for determining the remaining time in the constant-voltage

stage is in the constant-voltage stage. Ex. 1005 ¶0095. As discussed above with respect to Limitation [B], Kao teaches determining that its battery is in the constant voltage phase. *See* Ex. 1003 2:25-3:4. And, as discussed above in this limitation, Kao's "interval[s] i" are in the constant-voltage stage. Ex. 1005 ¶0095.

Therefore, Kao discloses "calculating, by the apparatus [*e.g.*, "device"], a time remaining to charge in the constant voltage phase [*e.g.*, "t_{cv}"] based on the constant voltage phase charging characteristics [*e.g.*, "OCV," "V_{lim}," "transition point," "I_{cv}", "$I_{termination}$"], if the battery charging point [*e.g.*, "SOC"] is in the constant voltage phase [*e.g.*, "Constant-Voltage" stage]." *Id.* ¶0096.

Limitation [E]

The claim requires that "the time remaining to charge in the constant current phase is based on **stored charge characteristics in the constant current phase**, when the battery charging point is in the constant current phase." This is disclosed by Kao. *Id.* ¶0097.

As discussed with respect to Limitation [B], Kao discloses using "predetermined constant current phase charging characteristics." As discussed above in Limitation [C], Kao discloses that these characteristics are used to determine the time remaining to charge in the constant current phase when the battery's charging point (state of charge) is in the constant current phase.

Kao discloses that at least some of its battery characteristics are stored. *Id.*,

¶0098.

Kao's Claim 8 requires "[t]he smart battery device of claim 2, wherein the microprocessor periodically **updates** the ATTF as stored charge of the battery pack increases." Ex. 1003 Cl. 8; *see* Cl. 14. Further Kao discloses that during operation, "[a]s charging is performed on the battery pack 200, the microprocessor may **update** state of charge SOC (Step 308)." *Id.* 4:33-34; *see* 2:53-54. This is illustrated in Figure 3.

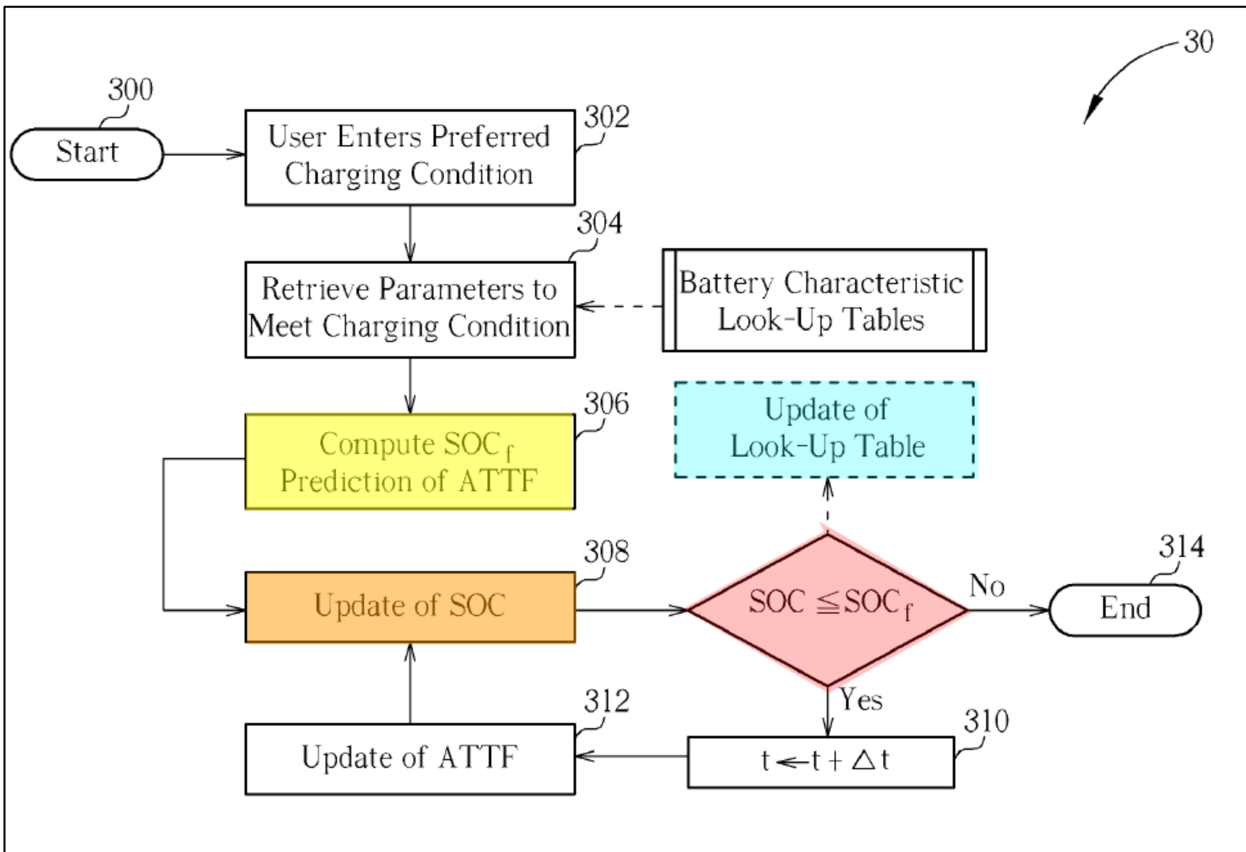

FIG. 3

Ex. 1003 Fig. 3.

As shown in Figure 3 (above), Kao writes parameters, including SOC, to its "Look-Up Table" (cyan). Kao expressly discloses "retrieving parameters corresponding to the preferred charging condition from a battery characteristic look-up table stored in a memory circuit of the smart battery device." Ex. 1003 2:47-50. Referring back to the above flowchart, "the microprocessor may retrieve parameters corresponding to the charging condition from the battery characteristic look-up tables stored in the embedded flash memory 212 (Step 304)." *Id.* 4:22-25. Kao further expressly discloses that its calculations "may be affected by…**information stored in the embedded flash memory** 212" confirming it uses the "stored" charge characteristics. *Id.* 4:29-32; Ex. 1005 ¶0100. For example, Kao then teaches that the (updated) SOC is used to determine whether to continue charging. *See id.* 4:34-43:

> If the state of charge SOC is less than the final state of charge SOC_f, the battery pack 200 is not charged to the preferred charge level, and the microprocessor increments a counter t by the count increment Δt (Step 310). The microprocessor then updates the ATTF in the embedded flash memory 212 (Step 312), and returns to Step 308 to update the state of charge SOC. **Steps 308 to 312 may be repeated until the state of charge SOC is greater than or equal to the final state of charge SOC_f**, at which point the process 30 may end

(Step 314).

As the examples above make clear, Kao also teaches that its characteristics relate to stored-charge in the battery.[7] Kao's Claims 8 and 14 require "the microprocessor periodically update[] the ATTF as **stored charge** of the battery pack increases." *Id.* Cls. 8 & 14. Further Kao discloses that during operation, "[a]s charging is performed on the battery pack 200, the microprocessor may update **state of charge SOC** (Step 308)." *Id.* 4:33-34; *see* 2:53-54. Kao further teaches that "a plurality of discrete points of the **state of charge** may be established, and the microprocessor may update the battery characteristic look-up table during charging each time **the state of charge passes one of the plurality of discrete points,**" *Id.* 4:44-48, and then uses the updated SOC in its calculations, *e.g.*, to update "counter t by…Δt," confirming it is relying on the battery's stored-charge. *Id.* 4:29-43 (reproduced above). For another example, Kao teaches "determining amount of charge Q_{Chg} that may be stored in the battery." *Id.* 5:12-

[7] While Petitioner believes "stored charge characteristics" means characteristics that are stored in memory (as Kao teaches), Patent Owner may argue that it means nothing more than characteristics of the charge stored in the battery. If so, as discussed directly below in this section, Kao discloses this, too. *See also* Ex. 1005 ¶0102.

14. "The constant current time t_{cc} may then be determined by…[using] the amount of charge Q_{Chg} stored." *Id.* 5:19-21; Ex. 1005 ¶0101.

As discussed above in Limitation [C], Kao's "calculating [of]…time remaining to charge in the constant current phase" is performed "when the battery charging point is in the constant current phase." Ex. 1005 ¶0101.

Therefore, Kao discloses "the time remaining to charge in the constant current phase [*e.g.*, "t_{cc}"] is based on stored charge characteristics in the constant current phase [*e.g.*, "Q_{Chg}" and/or "SOC" stored in "memory" (*e.g.*, "look-up table")] when the battery charging point is in the constant current phase." Ex. 1005 ¶0102.

<u>Limitation [F]</u>

The claim requires "battery stored charge characteristics comprises [*sic*] a **battery stored charge value** based on **monitored tracking of battery charging and discharging**." This is disclosed by Kao. Ex. 1005 ¶0103.

As discussed above with respect to Limitation [C], Kao tracks and stores the state-of-charge ("charging point" in '708 terminology) of the battery when the battery is in the constant-current stage.[8]

As discussed above with respect to Limitation 1[E], Kao discloses using

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[8] As discussed in Limitation [D], Kao also tracks it in the constant-voltage stage.

"[battery] stored charge characteristics."[9] Kao further discloses that the battery stored charge characteristics "compris[e] a battery stored charge value based on monitored tracking of battery charging and discharging."

The '708 patent does not disclose ***how*** to monitor the charging/discharging, instead stating that "the current measurement module 170 may be continuously monitored by the processor 120 to keep track of both discharging the battery 160, as well as charging the battery, thereby maintaining an updated **value** for the present **stored charge CAP in the battery**." Ex. 1001 9:30-34. While the '708

[9] Limitation [E] refers to "stored charge characteristics." Ex. 1001 Cl. 1. Petitioner believes "battery stored charge characteristics" is the same term as "stored charge characteristics," and incorporates its arguments from Limitation [E]. But, regardless of whether Patent Owner contends "battery stored charge characteristics" are the same or a different set of characteristics from "stored charge characteristics," and regardless of whether Patent Owner contends the term means characteristics stored in memory or characteristics relating to the battery's stored-charge, as discussed above in Limitation [E] and in this section, Kao discloses "battery stored charge characteristics" and that they comprise "a battery stored charge value based on monitored tracking of battery charging and discharging." *See also* Ex. 1005 ¶¶0102, 0105.

patent does not recite a Coulomb[10] counter, a PHOSITA at the relevant time would have known that a Coulomb counter "monitor[s] tracking of battery charging and discharging."[11] Ex. 1005 ¶0105. As discussed above with respect to Limitation [A], Kao discloses a Coulomb counter, shown (blue) below:

[10] A Coulomb (or "coulomb") is the SI unit of electrical charge. It is equal to the quantity of electricity conveyed in a single second by a single Ampere of current. In other words, C = A*t, where t is in seconds. Ex. 1005 ¶0106.

[11] Prior to the '708 patent's priority date, there were (and still are) two common types of battery "fuel gauges," Coulomb counters and impedance trackers. A PHOSITA prior to the '708 patent would have known that the disclosure of either discloses monitoring of battery charging and discharging. Ex. 1005 ¶0107.

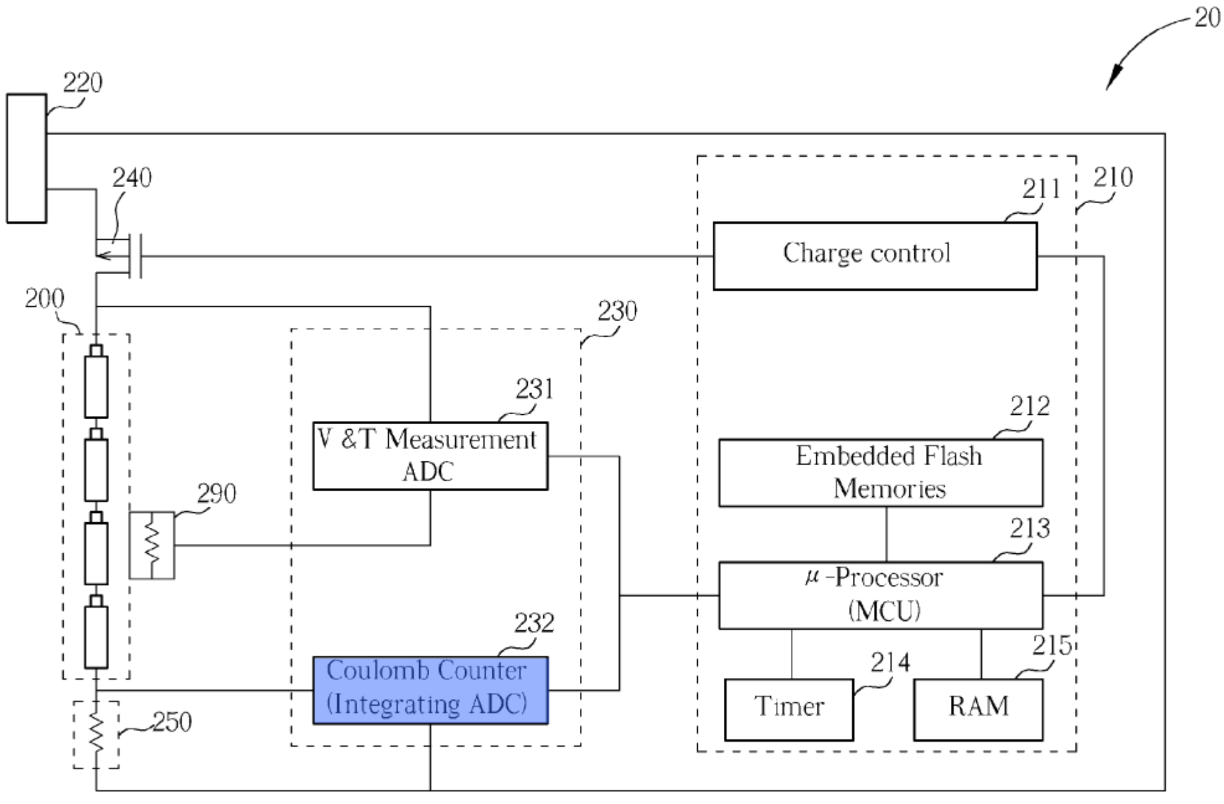

FIG. 2

Ex. 1003 Fig. 2.

Kao teaches that a "voltage drop across the sense resistor 250 may be detected by the Coulomb counter 232, integrated over time, and digitized into a battery charge signal sent to the microprocessor 213" to track the charging. Ex. 1003 3:59-61. Kao further explains that it "**store[s] charging characteristics**" and "**battery use…information**," which "may…affect[]" its calculation of, *e.g.*, time-to-charge. *Id.* 3:63-65, 4:29-32.

Therefore, Kao discloses "battery stored charge characteristics [*e.g.*, "SOC"

and/or "Q_{Chg}"] comprises a battery stored charge value [*e.g.*, "Q_{Chg}," and/or "SOC"] based on monitored tracking of battery charging and discharging [*e.g.*, Coulomb counting]." Ex. 1005 ¶0110.

In light of the above, it is clear that each limitation of independent claim 1 is taught by Kao. As such, claim 1 is anticipated by Kao. Ex. 1005 ¶0111.

2. Claim 4

Claim 4 requires, "[t]he method of claim 1, wherein the **time remaining to charge** in the **constant voltage phase** is based on **charging current characteristics** in the constant voltage phase, when the battery charging point is in the constant voltage phase," which is disclosed by Kao. Ex. 1005 ¶0112.

As explained with respect to Limitation 1[D], Kao explains that "[t]o predict the ATTF (Step 306), constant current time t_{cc} and **constant voltage time t_{cv} may be predicted**." Ex. 1003 5:9-10. The process is described in detail with respect to Limitation 1[D], incorporated here, but as part of the process, "constant voltage time t_{cv} may be approximated by predicting **constant voltage current I_{cv}** [*i.e.*, charging current characteristic(s)] at each interval i utilized for providing an amount of charge ΔQ." Each interval "i" where the current I_{cv} is predicted, is in the "constant-voltage" stage, as illustrated by the orange line below:

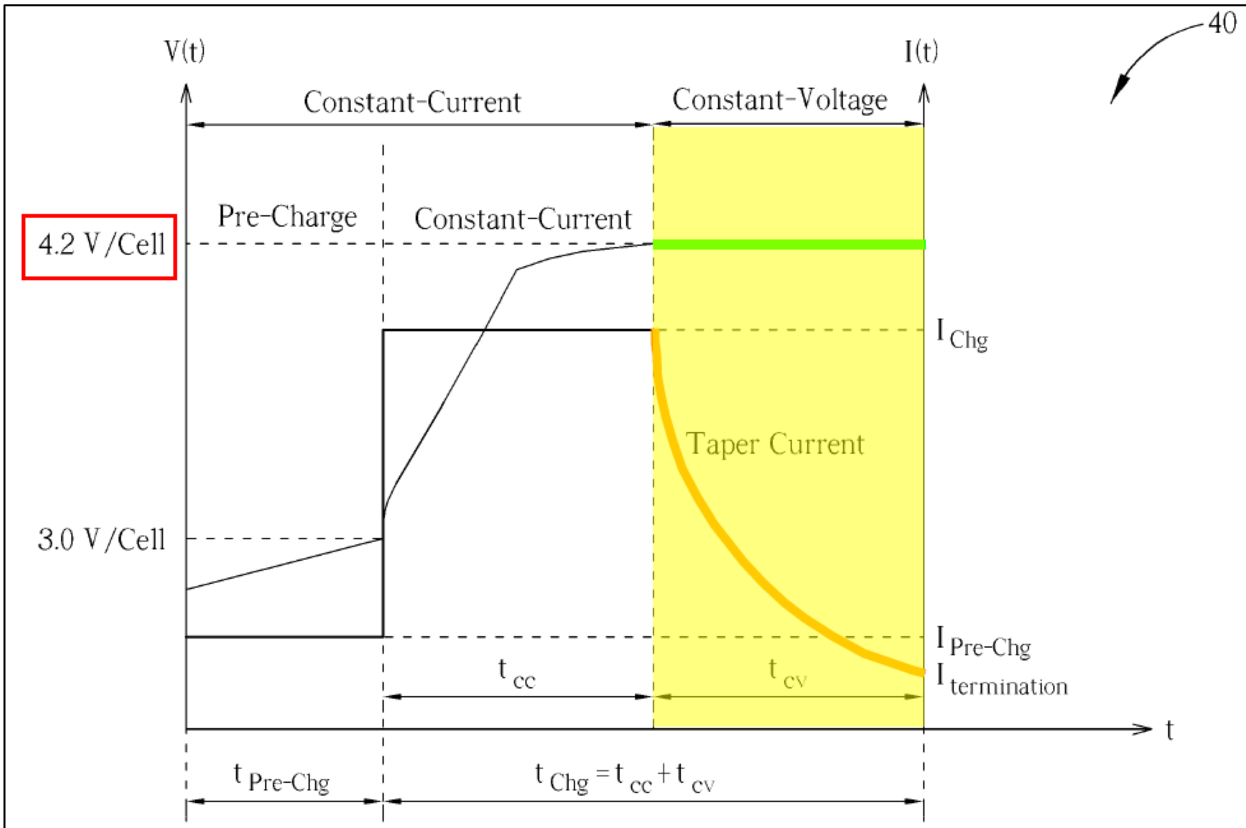

FIG. 4

Ex. 1003 Fig. 4 (showing OCV (green) of 4.2V and "taper[ing] I_{cv} (orange) in the "Constant-Voltage" phase). The taper current, I_{cv}, is a "charging current characteristics in the constant voltage phase." Ex. 1005 ¶¶0113-114.

Therefore, Kao discloses "the time remaining to charge in the constant voltage phase [*e.g.*, t_{cv}] is based on charging current[12] characteristics [*e.g.*, I_{cv}] in

[12] A PHOSITA would understand that the word "current" refers to electrical "current," not a present moment in time (*i.e.* "now"). Ex. 1005 ¶0115. To the

the constant voltage phase [*e.g.*, Constant-Voltage stage], when the battery charging point [*e.g.*, SOC] is in the constant voltage phase [*e.g.*, Constant-Voltage stage]." Ex. 1005 ¶¶0115-116.

3. Claim 7

Claim 7 requires, "[t]he method of claim 1, further comprising calculating, by the apparatus, a **time remaining to charge in the constant current phase** based on the **constant current phase charging characteristics** and a **time remaining to charge in the constant voltage phase** based on the **constant voltage phase charging characteristics**, if the battery charging point is in the constant current phase."

As an initial matter, in its Infringement Contentions, Patent Owner took the position that there is nothing new in this claim, instead referring to its allegations contained in the constant-current and constant-voltage phase limitations in claim 1. *See* Ex. 1012. Petitioner agrees, and incorporates its analysis from Claim 1, here.

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extent that Patent Owner contends that "current" means presently-in-time, Kao also discloses using values computed presently (*i.e.*, during the charging process). For example, Kao teaches both "comput[ing] SOC_f" and "update[ing]…SOC" during charging. Ex. 1003 4:9-11, Fig. 3; Ex. 1005 ¶0115.

But, to the extent that Patent Owner argues that something more is needed, Kao discloses this claim. Ex. 1005 ¶0118.

As discussed with respect to Limitation 1[A], Kao discloses an apparatus.

As discussed with respect to Limitation 1[C], Kao discloses "calculating…time remaining to charge in the constant current phase based on the constant current phase charging characteristics…if the battery charging point is in the constant current phase." For example, as discussed in Limitation 1[C], above, and incorporated here, Kao discloses determining **constant current time (t_{cc})**.

Further, Kao discloses "calculating…time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant current phase." As discussed with respect to Limitation 1[D], Kao discloses "calculating, by the apparatus, a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase." In addition to calculating the remaining time in the constant-voltage phase, Kao also discloses calculating t_{cv} (the time remaining in the constant-voltage stage) when in the constant current phase. This allows Kao to calculate ATTF (average-time-to-full) while in the constant-current stage. *See* Ex. 1003 5:3-5 (The "[s]um of the constant current time t_{cc} and the constant voltage time t_{cv} may be a charge time t_{Chg}."). Ex. 1005 ¶0119.

As discussed with respect to Limitation 1[B], Kao discloses multiple "characteristics" that it bases its time remaining "predictions" on, including: "ATTF," "preferred charging condition," "change point," "use history, firmware,…aging information," "charge profile[s]," "state of charge," "charge current I_{Chg}," "time threshold," "amount of charge Q_{chg}," "upper limit voltage V_{lim}," "open circuit voltage (OCV)," "termination current $I_{termination}$," "preferred charging time[, and] preferred charge level." *See* §IX.A.1[B]. Many of these are "constant voltage phase charging characteristics" that are used during the constant-current phase.

For example, as discussed above with respect to Limitation 1[C], the "change point" (aka "transition point") is the point in which, for a given battery profile, charging changes from constant-current to constant-voltage, and may range form 75-80% of full charge (SOC_f). Ex. 1003 5:12-21. Accordingly, "change point" is both a constant-current and constant-voltage characteristic. Ex. 1005 ¶¶0120-121. Similarly, because, as discussed above with respect to Limitation 1[C], the transition/change point is used to determine "the amount of charge Q_{Chg} to be stored during constant current charging," it is used during the constant-current phase. Ex. 1005 ¶0121.

As another example, "charge current I_{Chg}" is a "constant voltage phase charging characteristic." As is shown below, during the "Constant-Voltage" phase

(yellow), the current (orange) is decreased from an initial I_{Chg} to a final $I_{termination}$ value.

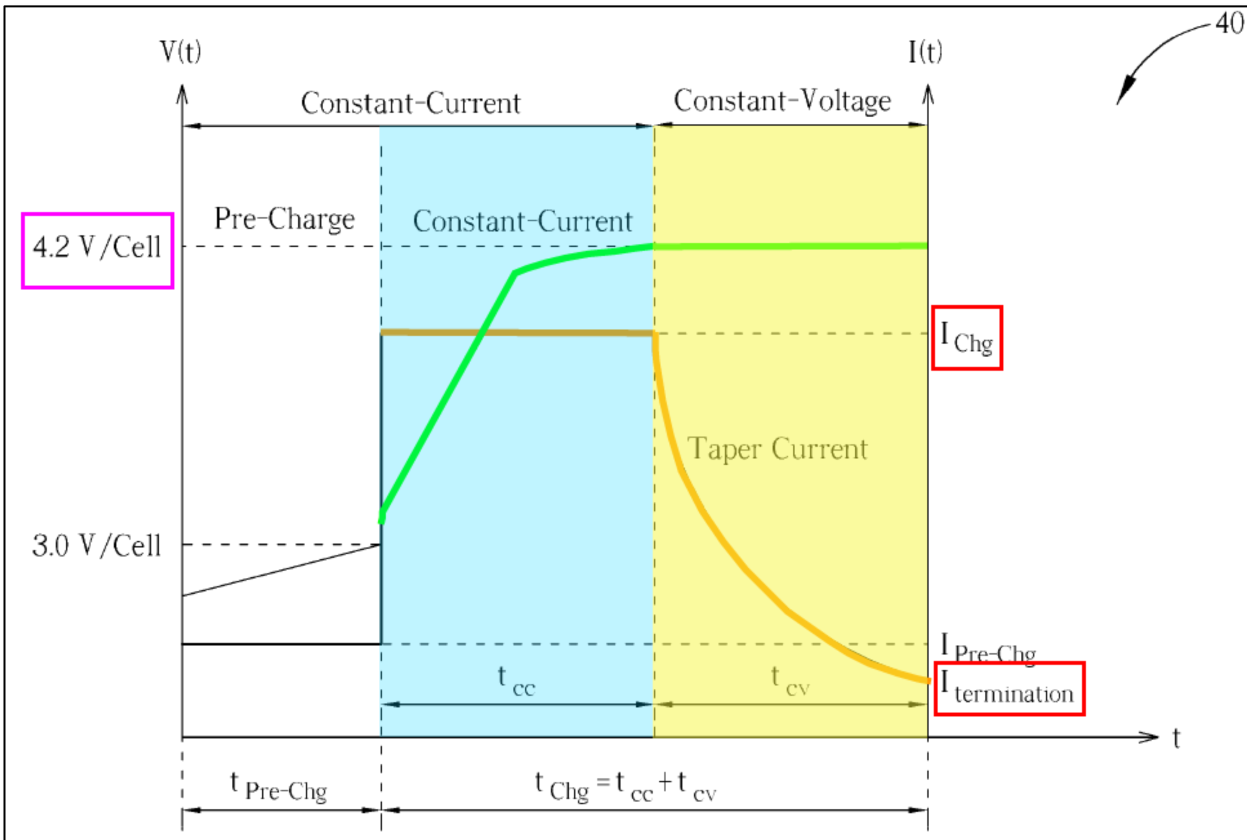


FIG. 4

Ex. 1003 Fig. 4. Because the value of I_{Chg}, along with $I_{termination}$, (both red) determines the tapering profile, they are both "constant voltage phase charging characteristics." Ex. 1005 ¶¶0122-123. As discussed above with respect to Limitation 1[C], I_{Chg} is used in the calculations during the constant-current phase (blue). Indeed, Figure 4B of the '708 patent shows "TERMINATION

CURRENT" (what Kao calls "$I_{termination}$") (red, above and below) in its "CONSTANT VOLTAGE PHASE," as shown below:

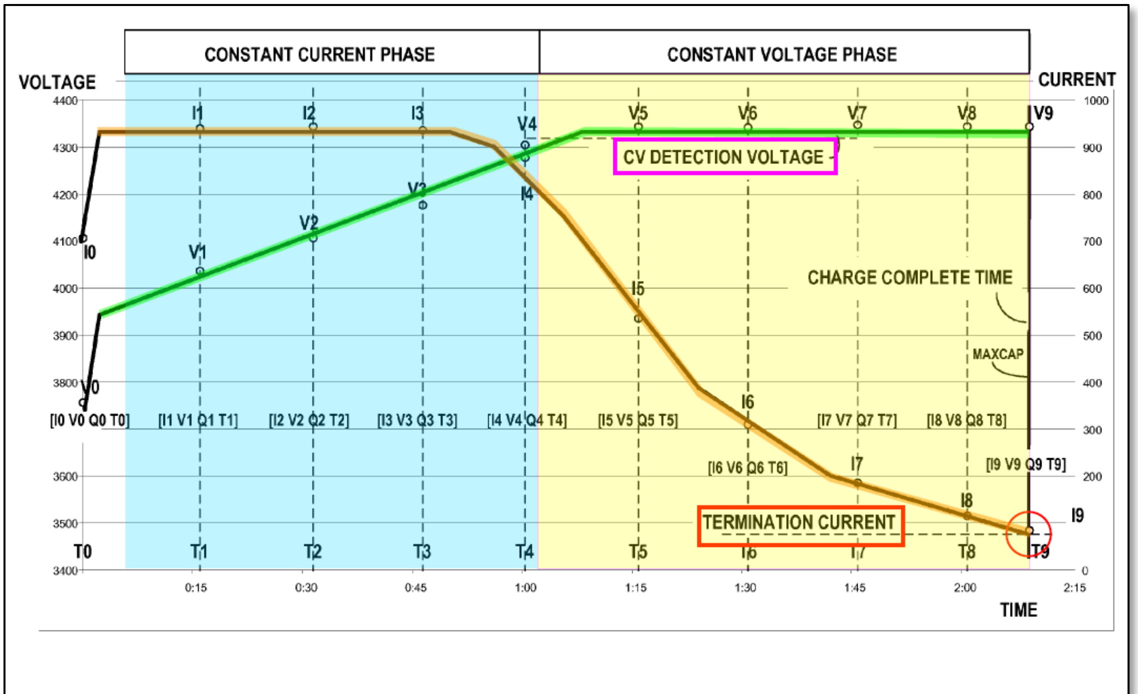


FIG. 4B

Ex. 1001 Fig. 4B (colored to match). The '708 makes clear that this time, T9, is a part of the charging time, and specifically states that "at T9…the charge that has accumulated in the battery is the sum of the incremental charges Q0+Q1+Q2+...+**Q9**." Ex. 1001 6:31-35 (second ellipses in original); Ex. 1005 ¶¶0123-125.

As another example, open-circuit voltage and/or upper-limit voltage V_{lim} (purple) are "constant voltage phase charging characteristics." As is shown in Kao's Figure 4, above, OCV and V_{lim} impact the change in voltage (green) during

the constant-current phase (blue), as its value (and that of the starting voltage) impact the change of voltage (and thus the current) in the constant-current phase. Ex. 1005 ¶0126.

Therefore, Kao discloses "calculating, by the apparatus [*e.g.*, "device"], a time remaining to charge in the constant current phase [*e.g.*, "t_{cc}"] based on the constant current phase charging characteristics [*e.g.*, "SOC," "I_{Chg}," "profile"] and a time remaining to charge in the constant voltage phase [*e.g.*, "t_{cv}"] based on the constant voltage phase charging characteristics [*e.g.*, "change point," "OCV," "profile," "I_{Chg}"], if the battery charging point [*e.g.*, "SOC"] is in the constant current phase [*e.g.*, "Constant-Current" stage]," *i.e.*, when in the constant-current stage, to calculate ATTF, both t_{cc} and t_{cv} are determined. Ex. 1005 ¶0127.

4. Claim 13

Claim 13 requires "[t]he method of claim 1, wherein a **remaining charging time** during the constant voltage phase is **estimated** as **a mapping from charging current, using pre-measured data**, when the battery charging point is in the **constant voltage phase**. This is disclosed by Kao. Ex. 1005 ¶0128.

As discussed in Limitation 1[D], Kao teaches that, as shown below, "constant voltage time t_{cv} may be approximated by predicting **constant voltage current I_{cv}** (orange) at each interval i utilized for providing an amount of charge

ΔQ."

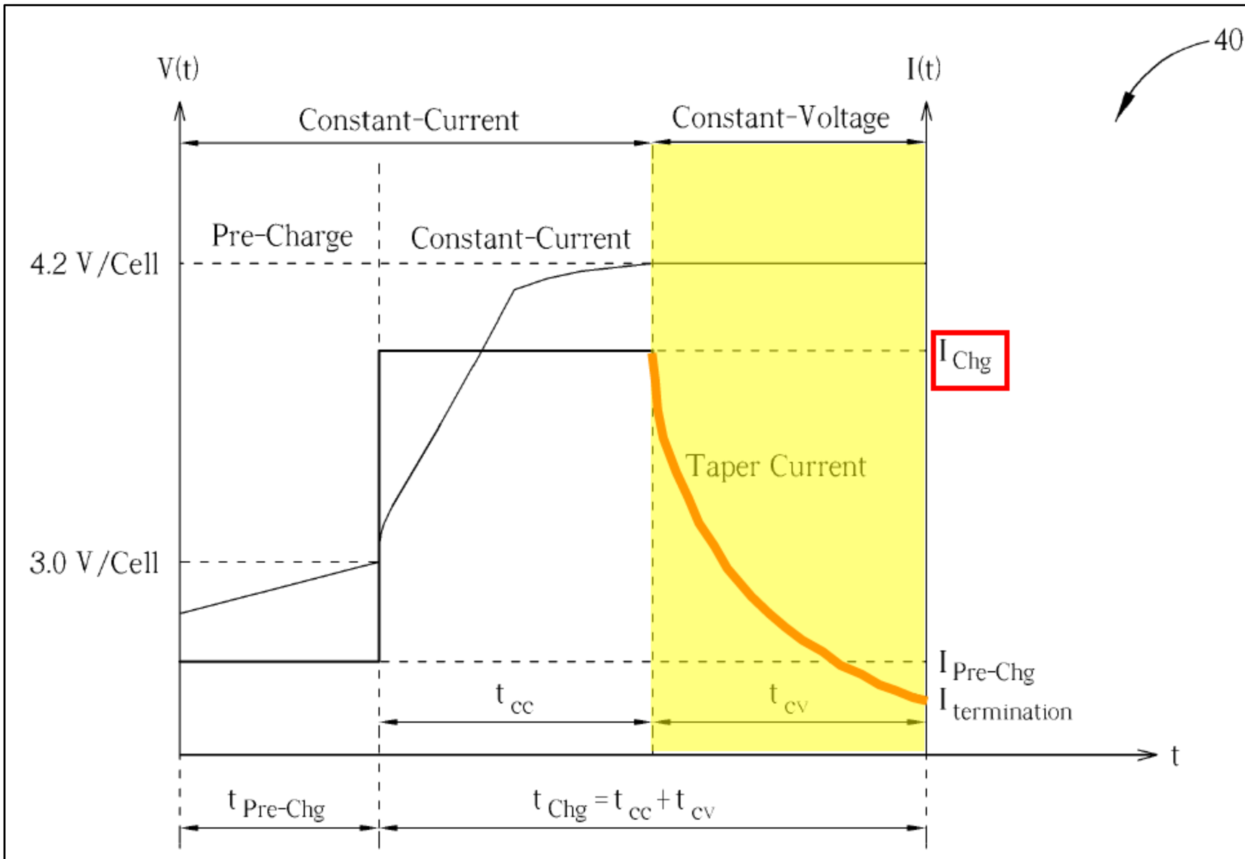


FIG. 4

Ex. 1003 Fig 4, 5:24-31; *see also* 4:63-67 ("Once the charged voltage is reached, a **taper current** may be applied to the battery pack 200, keeping the battery pack 200 at the charged voltage until the taper current reaches a termination current $I_{termination}$.").

Kao then explains that "[t]o determine interval constant voltage time $(\Delta t_{cv})_i$ for each interval i, the amount of charge ΔQ may be divided by the constant voltage current $(I_{cv})_i$." *Id.*, 5:40-43. Kao further teaches that "constant voltage

current $(I_{cv})_i$ may be calculated by [Eq.1]" and "constant voltage time t_{cv} may be calculated as [Eq.2]," both shown below:

$$(I_{CV})_i = \frac{V_{lim} - (OCV)_i}{(R_m)_i}.$$	$$t_{CV} = \sum_i (\Delta t_{CV})_i$$

Id., 5:33-49. Additional details of this process are discussed in Limitation 1[D]. As shown above, this process is done during the "Constant-Voltage" phase (yellow).

Therefore, Kao discloses "a remaining charging time during the constant voltage phase [*e.g.*, "t_{cv}"] is estimated as a mapping [*e.g.*, equation/formula calculation] from charging current [*e.g.*, "taper current" at each "interval i"], using pre-measured data [*e.g.*, data from "profile", "OCV_i"], when the battery charging point [*e.g.*, "SOC"] is in the constant voltage phase [*e.g.*, "constant-voltage" phase]." Ex. 1005 ¶0132.

5. Claim 14

<u>Preamble [P]</u>

The preamble recites "[a] non-transitory computer readable medium,

comprising program instructions, which when executed by a computer processor" perform the method. To the extent it is limiting, Kao discloses this limitation. As discussed above with respect to Limitation 1[A], incorporated here, Kao discloses performing a method. Kao further discloses "a related charging device" that performs the method. Ex. 1003 1:6-9. For example, Kao discloses it has "a **microprocessor**" that can perform the claimed method. *See id.* 4:1-48. It is shown below (orange):

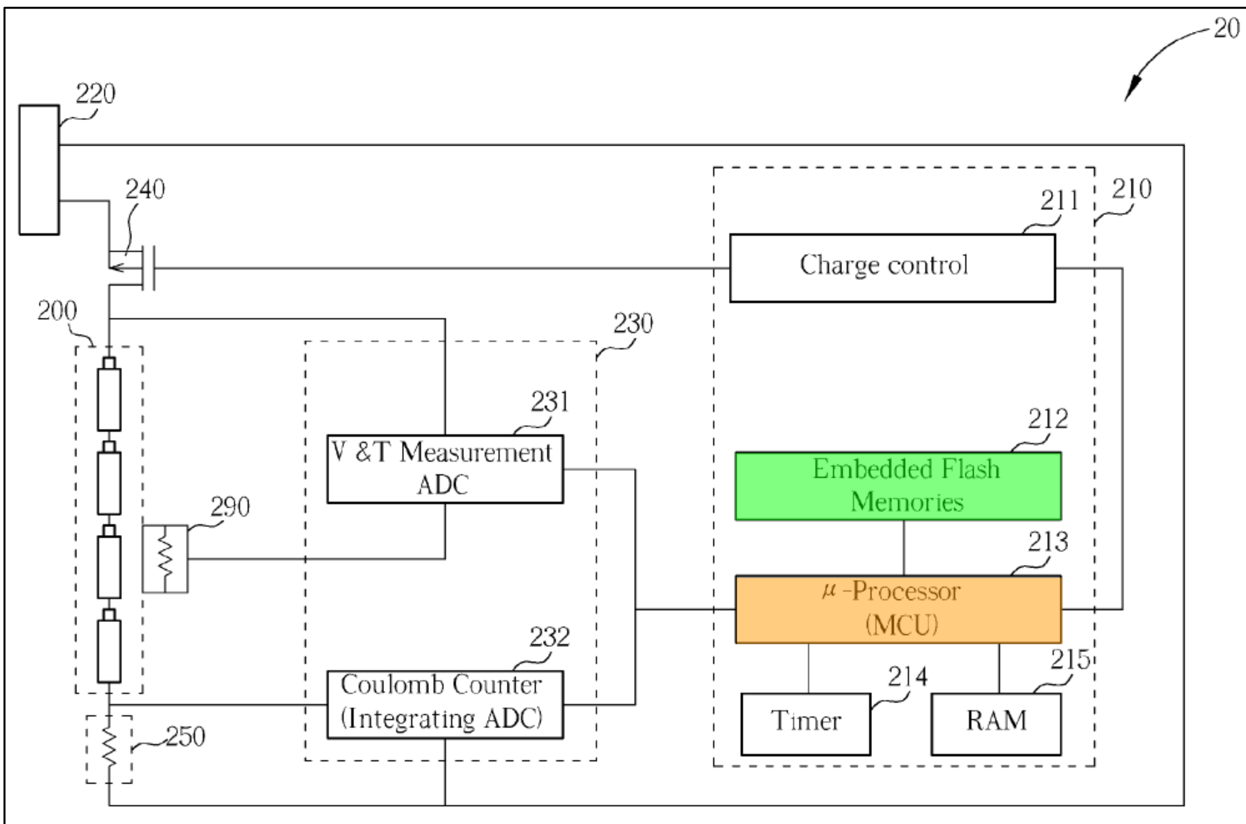


FIG. 2

Ex. 1003 Fig. 2. Kao's microprocessor has memory, including FLASH memory (green) which stores its instructions. For example, Kao teaches "flash memory 212

may store…**firmware**, and a **database**." Ex. 1003 3:63-64. It is thus a non-transitory computer-readable medium (*e.g.*, "flash memory") comprising program instructions (*e.g.*, "firmware"). Indeed, the '708 Patent discloses "firmware" stored in "ROM, PROMS, etc" as sufficient to "encompass a computer program…[in] any computer-usable medium." Ex. 1001 11:32-45; *see also* Ex. 1014 (Dictionary of Computer and Internet Terms), p192 ("firmware": "computer programs…that [are] stored in some fixed form, such as…FLASH MEMORY"). Kao's "microprocessor…access[es] the firmware…stored in [its] memory" when performing its battery-charging functions. Ex. 1003 Cl. 2.

As Kao's microprocessor performs the method based on "execut[ion]" of its memory's "program instructions" (*i.e.*, "firmware" in "flash memory") Kao discloses this limitation. Ex. 1005 ¶¶0134-136.

<u>Limitation [A]</u>

The claim requires "detecting an availability of **a charger adapter**." With the exception of excluding "by an apparatus," this limitation is identical to Limitation 1.[A]. It is disclosed for the same reasons discussed with respect to Limitation 1.[A] by Kao's apparatus, incorporated here. Ex. 1005 ¶0137.

<u>Limitation [B]</u>

The claim requires "**determining** whether a **battery charging point** is in a **constant current phase** or in a **constant voltage phase**, **based on pre-**

determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise **constant current phase charging characteristics** and **constant voltage phase charging characteristics**," which is substantially identical to Limitation 1.[B]. It is disclosed for the same reasons discussed with respect to Limitation 1.[B], incorporated here. Ex. 1005 ¶0138.

Limitation [C]

The claim requires "**calculating a time remaining to charge in the constant current phase** based on the **constant current phase charging characteristics**, if the battery charging point is in the **constant current phase**." With the exception of excluding "by the apparatus," this limitation is identical to Limitation 1.[C]. It is disclosed for the same reasons discussed with respect to Limitation 1.[C] by Kao's apparatus, incorporated here. Ex. 1005 ¶0139.

Limitation [D]

The claim requires "calculating **a time remaining to charge in the constant voltage phase** based on the **constant voltage phase charging characteristics**, if the battery charging point is in the **constant voltage phase**." With the exception of excluding "by the apparatus," this limitation is identical to Limitation 1.[D]. It is disclosed for the same reasons discussed with respect to Limitation 1.[D] by Kao's apparatus, incorporated here. Ex. 1005 ¶0140.

Limitation [E]

The claim requires "wherein the **time remaining to charge in the constant current phase** is based on **stored charge characteristics** in the constant current phase, when the battery charging point is in the **constant current phase**." This limitation is identical to Limitation 1.[E]. It is disclosed for the same reasons discussed with respect to Limitation 1.[E], incorporated here. Ex. 1005 ¶0141.

Limitation [F]

The claim requires "wherein battery stored charge characteristics comprises a **battery stored charge value** based on **monitored tracking of battery charging and discharging**." This limitation is identical to Limitation 1.[F]. It is disclosed for the same reasons discussed with respect to Limitation 1.[F], incorporated here. Ex. 1005 ¶0142.

6. Claim 15

Preamble [P]

The preamble recites "[a]n apparatus." To the extent it is limiting, Kao discloses this limitation. As discussed above with respect to Limitation 1[A], incorporated here, Kao discloses an apparatus. Ex. 1005 ¶0145.

Limitation [A]

The limitation recites "at least one processor." This limitation is disclosed by Kao. Ex. 1005 ¶0146.

Kao discloses "a microprocessor" that performs the claimed method. *See* Ex. 1003 4:1-48. A microprocessor is a processor. Ex. 1005 ¶0147; Ex. 1010, p231. It is shown below (orange):

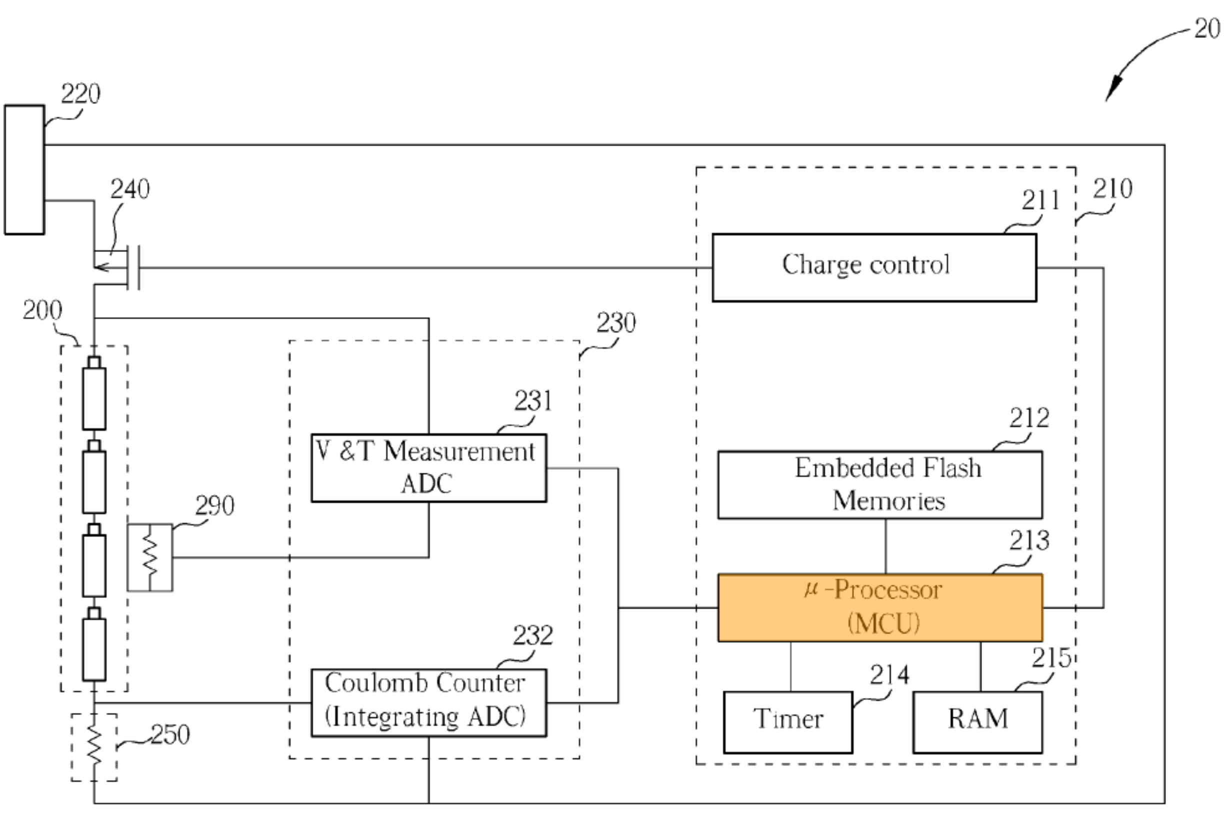


FIG. 2

Ex. 1003 Fig. 2; *see also* 3:29-32 ("The adaptive control circuit 210 may comprise a **microprocessor** 213."). Kao's microprocessor performs its method based on execution of "computer program code," disclosing this limitation. Ex. 1005 ¶0148.

Limitation [B]

The limitation recites "at least one memory including computer program code." As shown below, Kao discloses both a "**RAM**" (purple) and "**flash memory**" (green), both of which are "memory."

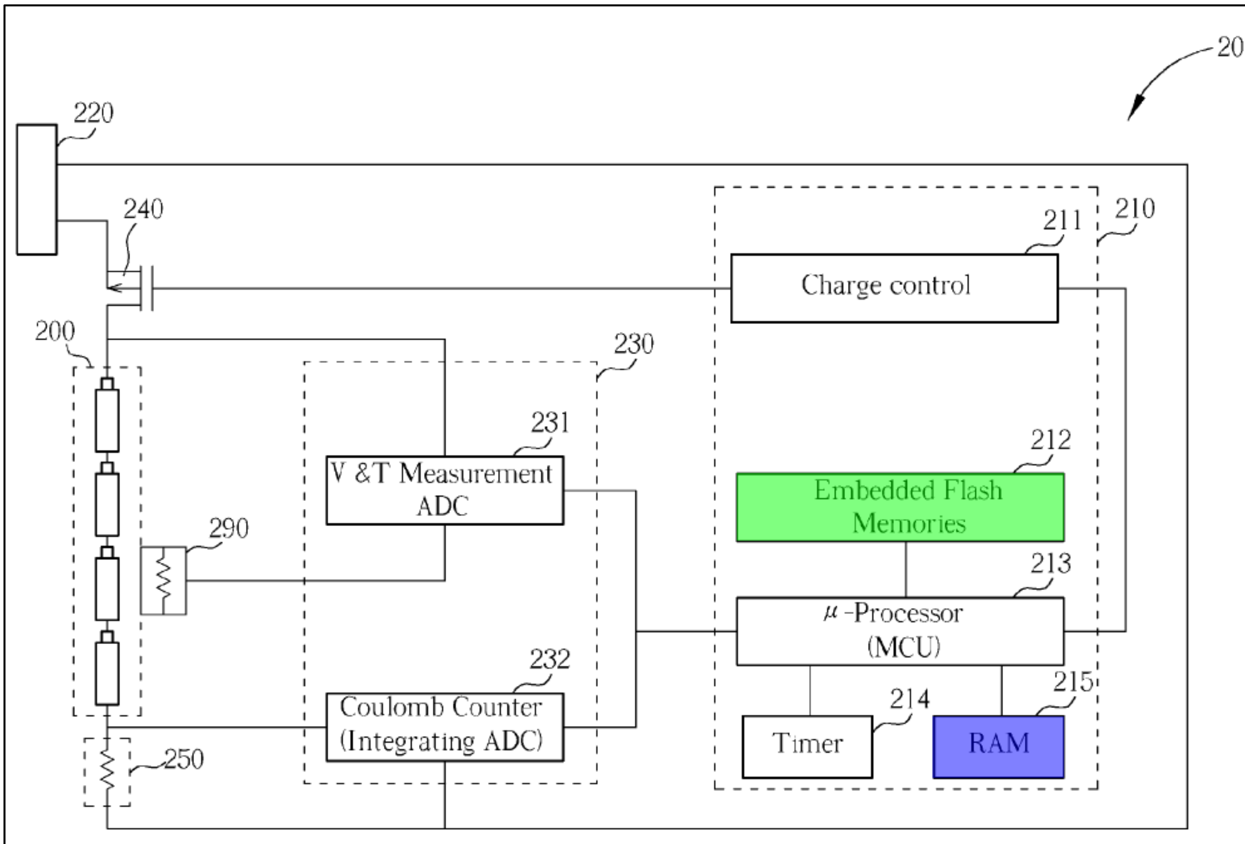


FIG. 2

Ex. 1003 Fig. 2; *see also* 3:29-32 ("The adaptive control circuit 210 may comprise…embedded flash **memory** 212 [and] random access **memory** (RAM) 215."). Kao's "flash memory 212 may store…**firmware**." *Id.* 3:63-64. A PHOSITA prior to the '708 patent's priority date would have known "firmware" is a "computer program." Ex. 1005 0149-150; Ex. 1014, p192 (defining "firmware"

as being a "computer program").

For the reasons discussed above and in Limitation 14[P], incorporated here, Kao discloses "at least one memory [*i.e.*, memory 212/215] containing computer program code [*i.e.*, firmware]." Ex. 1005 ¶0150.

Limitation [C]

The limitation recites "the at least one memory and the computer program code configured to, with the at least one processor, cause the processor at least to" perform the below method. For the reasons discussed above in Limitation 14[P], incorporated here, Kao's "memory," with its code (*e.g.*, "firmware"), causes its "microprocessor" to perform the claimed method. Ex. 1005 ¶¶0151-152.

Limitation [D]

The limitation recites "detect an availability of a charger adapter." Other than tense, this is the same limitation as 14[A], and is disclosed for the reasons given with respect to Limitation 14[A], incorporated here. Ex. 1005 ¶0153.

Limitation [E]

The limitation recites "determine whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics and constant voltage phase charging characteristics." Other than tense, this is the same

limitation as 14[B], and is disclosed for the reasons given with respect to Limitation 14[B], incorporated here. Ex. 1005 ¶0154.

Limitation [F]

The limitation recites "calculate a time remaining to charge in the constant current phase based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase." Other than tense, this is the same limitation as 14[C], and is disclosed for the reasons given with respect to Limitation 14[C], incorporated here. Ex. 1005 ¶0155.

Limitation [G]

The limitation recites "calculate a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase." Other than tense, this is the same limitation as 14[D], and is disclosed for the reasons given with respect to Limitation 14[D], incorporated here. Ex. 1005 ¶0156.

Limitation [H]

The limitation recites "wherein the time remaining to charge in the constant current phase is based on stored charge characteristics in the constant current phase, when the battery charging point is in the constant current phase." This is the same limitation as 14[E], and is disclosed for the reasons given with respect to Limitation 14[E], incorporated here. Ex. 1005 ¶0157.

Limitation [I]

The limitation recites "wherein battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging." This is the same limitation as 14[F], and is disclosed for the reasons given with respect to Limitation 14[F], incorporated here. Ex. 1005 ¶0158.

B. GROUND #2: Claims 1-2, 4-7 and 13-16 are Rendered Obvious by Kao and the USB Battery Charging Specification

Ground 2 incorporates all arguments included in Ground 1. In the unlikely event that the Board finds any claim element not explicitly or inherently disclosed by Kao, then it would have been obvious for one of skill in the art at the time of the invention to modify Kao to arrive at the claimed invention. *See* Ex. 1005 ¶0159.

Claims 1, 14, and 15 each require "**detecting**…[the] availability of a charger adapter." Claims 5 and 6 concern identifying the **category** of the detected charger and then using that information to "**configur[e]…charging**" (Claim 5) or "**improve [the] accuracy** of…charging time estimation" (Claim 6).

Detecting the availability of the charger adapter is both explicitly and inherently disclosed in Kao (and, indeed, is required to perform Kao's claimed method). *See*, *e.g.*, Ex. 1003 Cl. 9; Ex. 1005 ¶0160. The USB Battery Charging Specification ("USB-Specification") also explicitly discloses this step; discloses

detecting the type/category of adapter; and discloses having different charging profiles and configurations for each category/type of charger.

Notably, while the ’708 Patent does not mention or cite to the USB-Specification, it discloses the same exact examples as the USB-Specification that were published over three years earlier, providing an indication that its authors were aware of and using the USB Specification to guide their purported invention.

A PHOSITA would have been motivated to combine Kao with the USB-Specification, as both (and the ’708 patent) are in the same field of endeavor (*i.e.*, battery charging). A PHOSITA reading Kao would have looked to the USB-Specification, as it was the most popular option for coupling and providing power to charge devices at that time. Ex. 1005 ¶0161. Indeed, Gizmodo stated in 2008 that USB is “the gold standard” and “will connect everything,” and provided a link to USB-Specification. Ex. 1008. Kao encourages PHOSITAs to look for ways to connect devices to chargers, as it teaches that “using the method and device described [in Kao], the user is provided…a basis for determining what kind of charging configuration to use.” Ex. 1003 5:64-67. A PHOSITA reading this final paragraph in Kao would be motivated to look up the specifications for battery chargers to determine the appropriate “charging configuration[s]” described in Kao. As USB charging was (and still is) the “gold standard” for connecting and charging devices, it would naturally have been on a PHOSITA’s short list of

resources to refer to. Further, Kao's method teaches a PHOSITA how to predict the time remaining in multiple phases of charging (and overall), and teaches uses different "charging condition[s]" such as "rapid…or full charging," and that other "user-defined charging condition[s]," exist. Ex. 1003 4:18-19, Cl. 12. A PHOSITA reading Kao would have been motivated to investigate the different types of charging conditions offered. As USB charging was one of the most popular means of charging, a PHOSITA would have been motivated to look at the USB-Specification to determine the various charging conditions, such as "dedicated" (*e.g.*, a wall charger), "host" (*e.g.*, a device-based charger), etc. Ex. 1005 ¶¶0161-162.

A PHOSITA would have expected success as the USB-Specification taught many of the most popular types of charger configurations and conditions in use at the time of the '708 patent, and when combined with Kao, would result in a working system. Ex. 1005 ¶0163.

1. Claims 1, 14, and 15

Limitations 1[A], 14[A], 15[D]

As discussed above when discussing the respective limitations, Limitations 1[A] and 14[A] recite "**detecting**…an **availability of a charger adapter**" and 15[D] recites "**detect** an **availability of a charger adapter**." Ex. 1001 Cls. 1, 14-15.

To the extent that Kao does not disclose detecting the availability of a charger adapter, this is explicitly disclosed in the USB-Specification. USB-Specification states that, when attached, "a portable device **detects** that it is attached to a USB charger." Ex. 1004 §3.4. In §3, "**Detection** Mechanism," USB-Specification teaches "device[s]…determine what it is attached to," and respond "appropriately." *Id.*, §3.1. As discussed in Ground 1, the '708 patent does not claim any use of the detection of the adapter and does not recite it (or the "charger adapter") in any other limitation in the independent claims. Ex. 1001 Cl. 1. Nor does it disclose how it performs detection. Ex. 1005 ¶0166. The USB-Specification, however, provides details of its detection in the following subsections. Ex. 1004, pp9-19; Ex. 1005 ¶¶0166-0169.

Therefore, Kao with USB-Specification discloses "detecting an availability of a charger adapter [*e.g.*, USB-Specification's "Detection Mechanism" to detect a charger]." Ex. 1005 ¶0169.

<u>Limitations 1[F], 14[F], 15[I]</u>

These limitations require that "battery stored charge characteristics comprises [*sic*] a **battery stored charge value based on monitored tracking of battery charging and discharging**." To the extent Kao's "Coulomb counter" does not expressly or inherently disclose "monitored tracking of battery charging and discharging," it would have been obvious to a PHOSITA prior to the '708

Patent, from Kao's teachings. Kao discloses that it has a Coulomb counter that is connected so as to track the incoming/outgoing current. Ex. 1003 Fig. 2. Coulomb-Counters use a voltmeter, ammeter, and clock inside the battery to **measure the energy in & out of the battery** pack. Ex. 1005 ¶0170.

A PHOSITA prior to the '708 patent's priority date would have known monitoring tracked charge/discharge is what a Coulomb counter is used for. *Id.*

Therefore, Kao renders obvious "battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging [*e.g.*, output of Coulomb counter]." Ex. 1005 ¶0171.

Other Limitations

As discussed in Ground 1, each of the remaining limitations of claims 1 and 14-15, and the challenged dependent claims, are disclosed by Kao.

2. Claim 2

Claim 2 requires "[t]he method of claim 1, wherein the **battery stored charge characteristics** comprise **data** that provides **a remaining charging time estimate based on a battery stored charge estimate**," which is disclosed or rendered obvious by Kao. Ex. 1005 ¶0172.

As discussed above in Limitations 1[B-C & E], Kao discloses calculating

both the remaining times in the constant-current and constant-voltage phases based on the characteristics, including "[battery] stored charge characteristics," such as SOC.[13] Kao further discloses that it uses this information to provide an overall remaining charging-time estimate. Ex. 1005 ¶0173.

In particular, Kao teaches that "[b]y approximating the ATTF [*i.e.*, average-time-to-full] using [its] method…the user is provided with a more accurate estimate of the ATTF." Ex. 1003 5:64-66. To do this, Kao "computes a final state of charge[,]…updates a state of charge" and "when the state of charge is less than the final state of charge…,**update[es] the ATTF**." Ex. 1003 2:44-60 (embodiment summary). This process is illustrated in flowchart Figure 3:

[13] Limitation 1[E] recites "stored charge characteristics," not "battery stored charge characteristics." Ex. 1001 Cl. 1. As discussed above in footnote #9, Petitioner believes these two terms are the same. But, whether Patent Owner contends these are the same or separate claim elements, as explained in this section, Kao's SOC, Q_{Chg}, and/or ATTF discloses these characteristics and that Kao's characteristics "comprise data that provides a remaining charging time estimate based on a battery stored charge estimate.

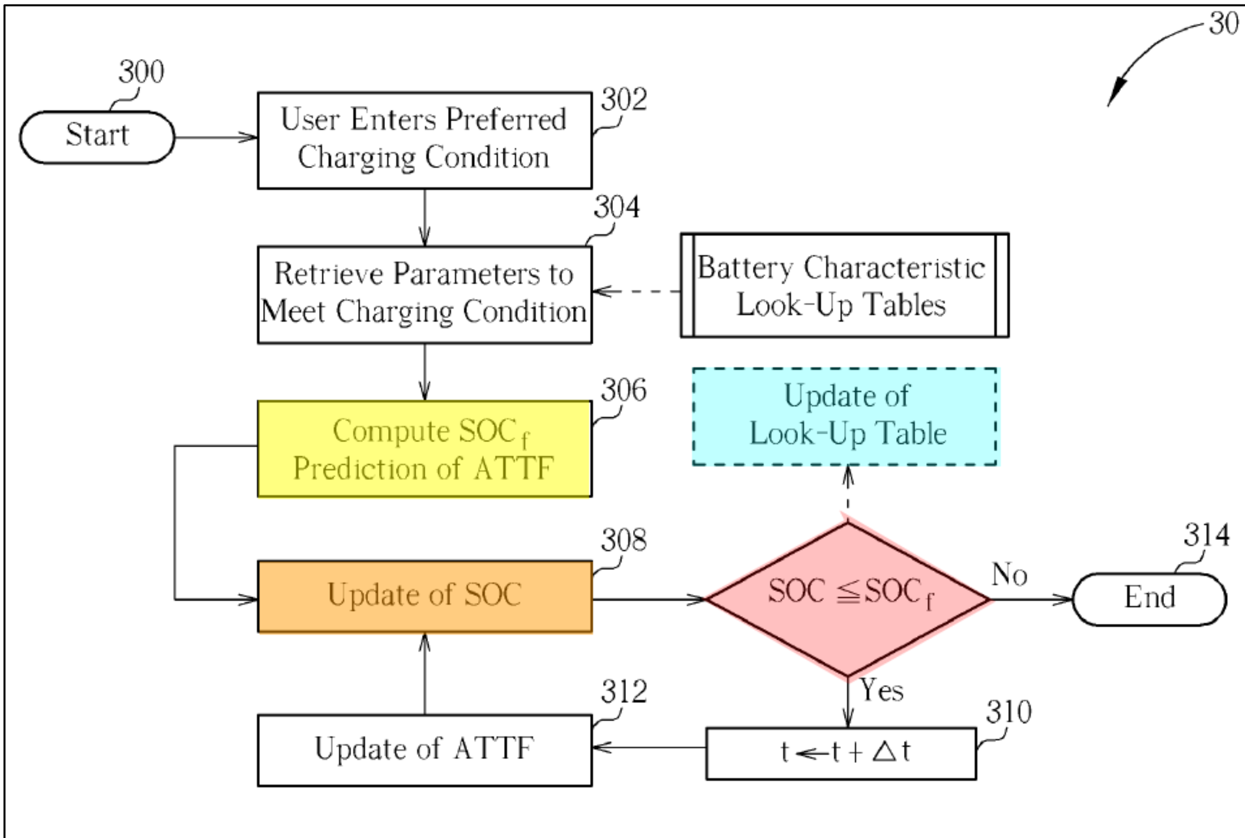


FIG. 3

Ex. 1003 Fig 3. In "Step 306," Kao "retrieves parameters corresponding to charging condition from battery characteristic look-up tables," which, as discussed above with respect to Limitation [B], includes ATTF, or the time remaining to charge. Specifically, Kao teaches that "ATTF" is a an "SBS parameter[]" that may

be "**receive[d]…from the rechargeable battery**."[14] Ex. 1003 1:29-30. In other words, ATTF is a stored charge characteristic. Ex. 1005 ¶¶0174-175. Kao "computes SOC_f [the "full" charge]" and recursively "updates SOC" "and predicts ATTF" "if $SOC \leqq SOC_f$." *Id.*; Ex. 1003 4:6-16.

In the '708 patent, "stored battery charge" is defined as "CAP(t)." *See* Ex. 1001 7:8-10 (Figure 4C shows "data points for values of stored battery charge CAP(t) versus remaining charging time TREM"). It clarifies that "CAP(t)" is the battery's "**capacity,**" which the '708 patent asserts "is unique for each device 100 model and battery 160 model." *Id.*, 5:46-47, 7:8-13. The '708 patent teaches that constant-current charging must stop at this capacity point. *See id.*, Fig. 4C. Kao similarly discloses "determining [the] **amount of charge Q_{Chg} that may be stored in the battery**."[15] Ex. 1003 5:13-15. Kao further teaches that this may be "based on…a charging percentage…corresponding to how fully the battery pack 200 is

[14] "ATTF" means "Average-Time-To-Full," *i.e.*, the time remaining to charge the battery. Ex. 1003 1:27-32. "SBS" means "Smart Battery System," *i.e.*, the system described in Kao. *Id.*

[15] Even if Patent Owner argues "stored charge characteristics" mean "stored-charge characteristics" as opposed to "stored charge-characteristics" (note hypenization), this is disclosed by Kao. Ex. 1005 ¶0097, ¶0177.

charged." *Id.* 5:15-18. Like the '708 patent, Kao teaches that this varies by battery, and specifically teaches that it "may be…e.g. 75% or 80%." *Id.* 5:16-17. Ex. 1005 ¶0176.

Therefore, Kao discloses "the battery stored charge characteristics [*e.g.*, "ATTF," "Q_{Chg}," and/or "SOC"/"SOC_f"] comprise data [*e.g.*, "Q_{Chg}," stored "ATTF," and/or "SOC"/"SOC_f"] that provides a remaining charging time estimate [*e.g.* "t_{Chg}," determined "ATTF"] based on a battery stored charge estimate [*e.g.*, "SOC"/"SOC_f," "Q_{Chg}," and/or "profile"]." Ex. 1005 ¶0177.

3. Claim 5

Preamble:

Claim 5 requires "[t]he method of claim 1, further comprising." The preamble is not limiting. As discussed above, Kao in view of USB-Specification renders Claim 1 obvious. Ex. 1005 ¶0179.

Limitation [A]

Claim 5 requires "identifying, by the apparatus, a **correct category** of the charger adapter after detecting its availability." This is disclosed by the USB Battery Charging Specification v1.0 and thus rendered obvious by Kao in view of USB-Specification. Ex. 1005 ¶0180.

USB-Specification discloses using at least the charger adapter categories of

"Dedicated Charger" and "Host/Hub Charger," showing the device with the battery in blue and the charger adapter in yellow:

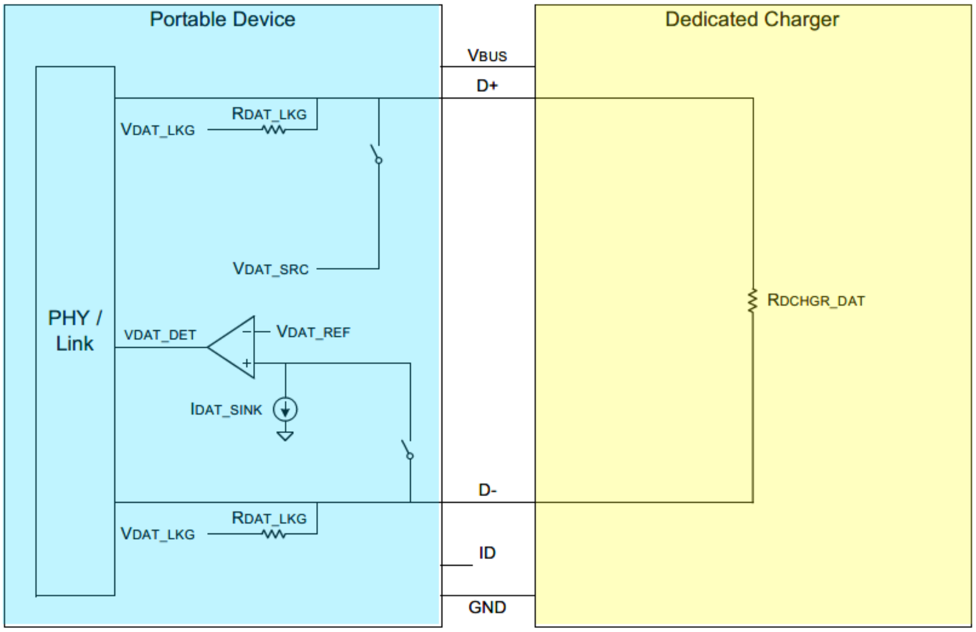


Figure 3-2 Dedicated Charger

Ex. 1004 Fig. 3-2.

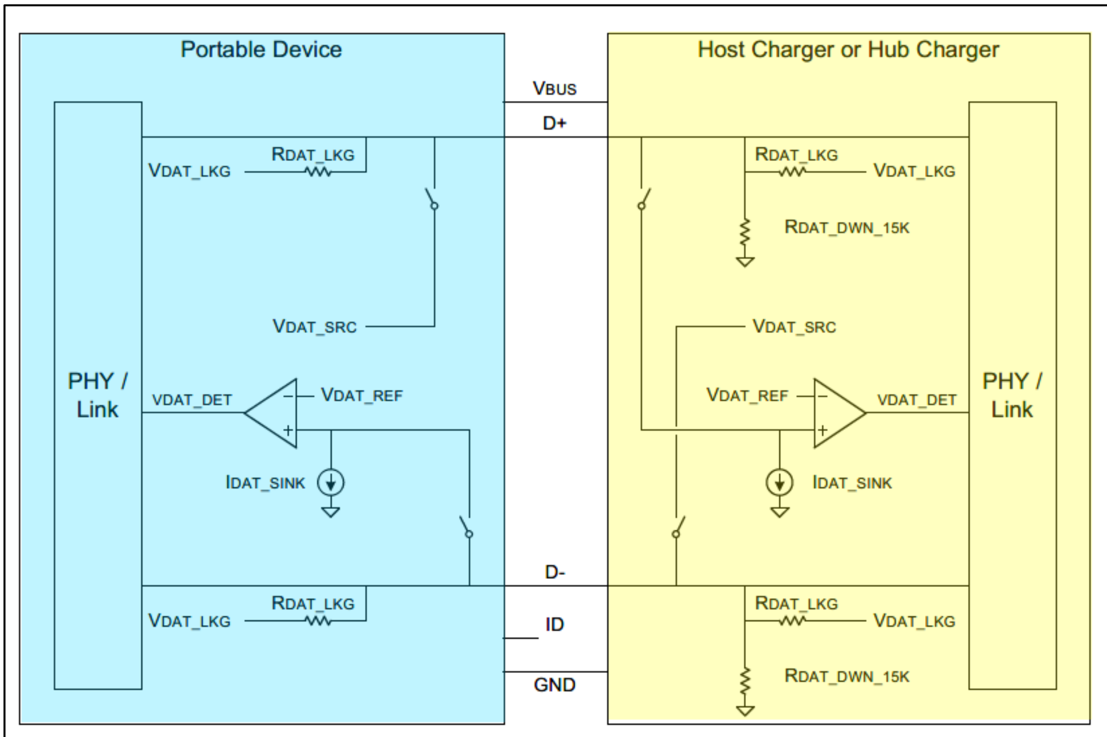


Figure 3-4 Host Charger or Hub Charger

Ex. 1004 Fig. 3-4; *see id.*, §1.3.6 ("A USB charger is **either** a **dedicated charger**, **host charger** or **hub charger**."). Based on the category of charger, "[a]fter a device is connected,…the device [may] draw up to…**100mA** max, or **500mA** max, depending on the configuration." Ex. 1004 §2.1, Fig. 2-1. To determine how much power to draw, the device identified whether the charger was "dedicated," or a "host/hub" capable of providing a given power level. The '708 patent does not say what it means by a "***correct*** category," but, by determining the charger category, Kao and USB-Specification provide the "correct" one for the current being applied for charging. Notably, these are the same categories disclosed by the '708 Patent. Ex. 1005 ¶¶0180-182; *see* Ex. 1001 8:20-29 ("These categories…may

be…[a] **dedicated charger**…USB…**500 mA** mode…or…USB…**100 mA** mode.”).

Therefore, Kao with USB-Specification discloses “identifying, by the apparatus [*e.g.*, “device”], a correct category of the charger adapter [*e.g.*, “Dedicated,” “Host/Hub Charger”] after detecting its availability.” Ex. 1005 ¶0183.

Limitation [B]

This limitation requires “configuring, by the apparatus, battery charging based in the category of the charger adapter.”[16] This is disclosed by Kao and the USB-Specification and thus rendered obvious by them. Ex. 1005 ¶0184.

Kao teaches that “using the method and device described [in Kao], the user is provided…a basis for determining what kind of charging configuration to use.” Ex. 1003 5:64-67. USB-Specification similarly teaches that “depending on the configuration,” the device can draw, *e.g.*, “100mA” or “500mA.” Ex. 1004 §2.1; *see* §1.2. These are the same example configurations provided in the ’708 Patent. Ex. 1005 ¶0185; *see* Ex. 1001 8:33-39 (“Detection of the type of charger adapter 50 may be used to configure charging. Categories of charger adapter 50

[16] For the purposes of this proceeding, Petitioner will treat “in” as a typo intended to be “on.”

include…a USB500 charger (providing maximum 500 mA) or a USB100 charger (providing maximum 100 mA).”).

Therefore, Kao with USB-Specification discloses “configuring, by the apparatus, battery charging based in the category of the charger adapter [*e.g.*, USB charger categories].”[17] Ex. 1005 ¶0186.

4. Claim 6

Preamble and Limitation [A]

These limitations require “[t]he method of claim 1, further comprising: identifying, by the apparatus, a **correct category** of the charger adapter after detecting its availability,” and are identical to Limitations 5[P,A]. As discussed with respect to those limitations, incorporated here, Kao with the USB-Specification discloses these. Ex. 1005 ¶¶0188-189.

Limitation [B]

This limitation requires “**using**, by the apparatus**, the category** of the charger adapter to **improve accuracy of an initial remaining charging time estimation**.” This is rendered obvious by Kao with the USB-Specification. Ex. 1005 ¶0190.

---

[17] Petitioner reserves the right to argue this limitation is indefinite and/or is neither enabled nor supported by its specification in other fora.

The ’708 patent does not explain ***how*** knowledge of the “correct category of the charger adapter…improve[s] accuracy,” instead stating only that knowing it “may help improve the accuracy right after the charger has been connected.” Ex. 1001 8:32-39; Ex. 1005 ¶0191.

Kao teaches that “using the method and device described [in Kao], the user is provided…a basis for determining what kind of charging configuration to use.” Ex. 1003 5:64-67. Kao then states that “charging settings may be optimized for time or fullness.” *Id.* 5:67-6:2.

As discussed above in Limitation 5[B], USB-Specification teaches that different power values can be determined, which permits more accurate initial estimations of charging time. Ex. 1004, p1, p3. For example, as discussed in connection with Claim 5, above, USB-Specification discloses that the different charger categories provide different current draws, and gives examples of, *e.g.*, “100mA” or “500mA.” Ex. 1004 §2.1, §1.2. By determining the different maximum amounts of current that can be obtained, the prediction of the estimated time is improved. While the ’708 patent does not disclose how its accuracy is improved, as discussed in Limitations 1[B-C], incorporated here, Kao teaches that its t_{cc} is calculated, *e.g.*, on I_{Chg}. Thus, whether I_{Chg} is limited to a particular I_{Chg}, *e.g.*, 100mA or 500mA, allows Kao to improve its estimation accuracy. Ex. 1005 ¶0193.

Further, USB-Specification shows, for certain examples, pre-determined power profiles, which also permit more accurate initial time estimations:

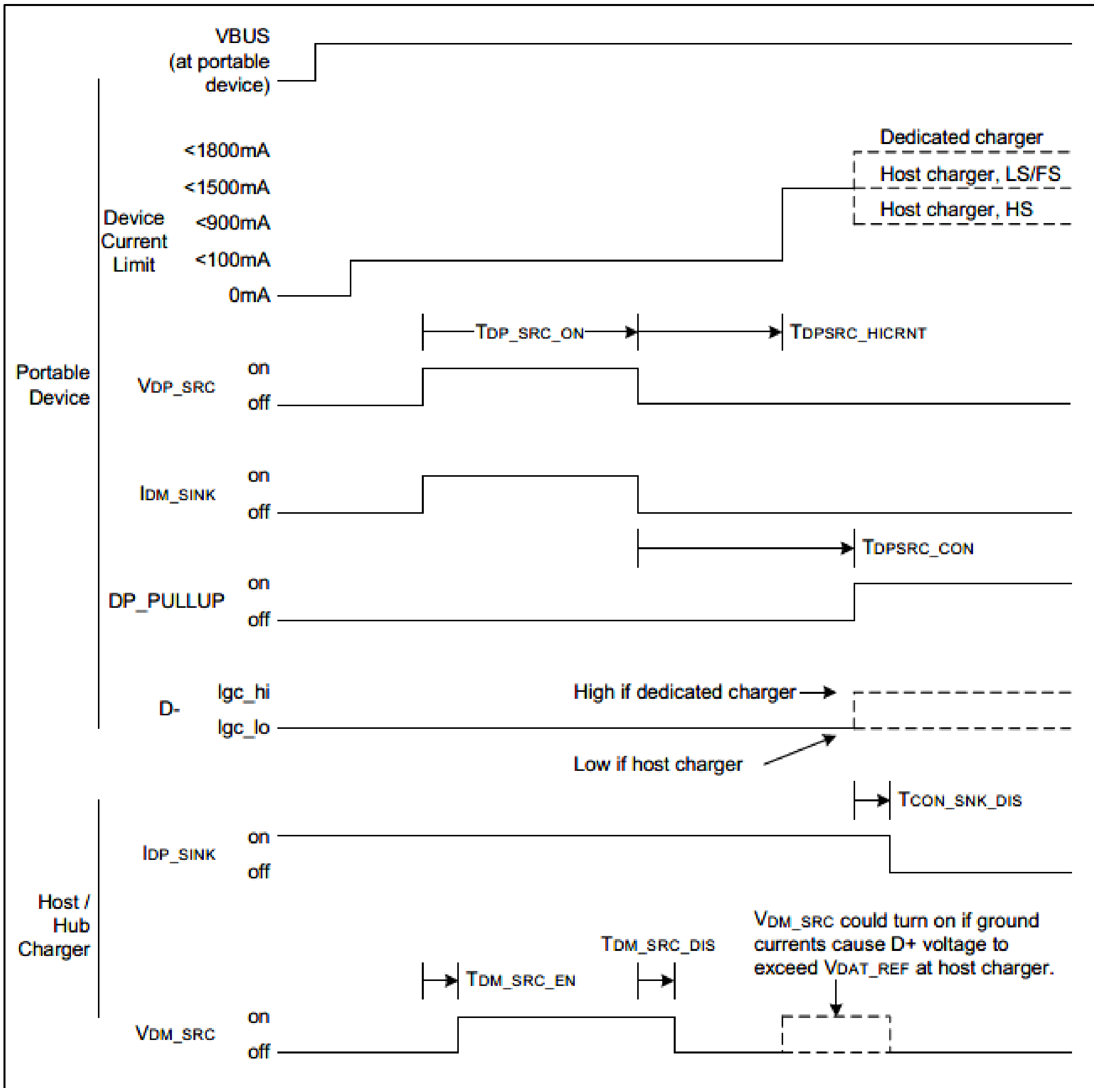


Figure 3-5 Charger Detection Timing

Ex. 1004 Fig. 3-5; Ex. 1005 ¶0194.

Therefore, Kao with USB-Specification discloses "using, by the apparatus [*e.g.*, device], the category of the charger adapter [*e.g.*, USB charger category] to improve accuracy of an initial remaining charging time estimation [*e.g.*, ATTF,

t_{Chg}]."[18] Ex. 1005 ¶0195.

5. Claim 16

Claim 16 recites "[t]he apparatus of claim 15, wherein the battery stored charge characteristics comprise data that provides a remaining charging time estimate based on a battery stored charge estimate." Aside from its parent claim, this claim is identical to Claim 2, and is disclosed for the reasons given with respect to Claim 2, incorporated here. Ex. 1005 ¶0196.

C. GROUND #3: Claims 1-2, 4-7 and 13-16 Are Rendered Obvious by Kao, the USB Battery Charging Specification, and MAXIM

Ground 3 incorporates all arguments included in Grounds #1-2. In the unlikely event that the Board finds a claim element not disclosed by Kao or rendered obvious by Kao and USB-Specification, then it would have been obvious for one of skill in the art at the time of the invention to modify Kao to arrive at the claimed invention further in view of MAXIM. *See* Ex. 1005 ¶0198.

Claims 1, 14, and 15 each require "a battery stored charge value based on

[18] Petitioner reserves the right to argue this limitation is indefinite and/or is neither enabled nor supported by its specification in other fora.

monitored tracking of **battery charging and discharging**."

Petitioners contend this is disclosed by Kao's disclosure of a Coulomb counter (Ground 1), or at the very least, it would have been obvious that Kao's Coulomb counter would monitor tracking of battery charging and discharging (Ground 2). But, if not, MAXIM makes it explicit. Ex. 1005 ¶0199.

A PHOSITA would have been additionally motivated to combine Kao with MAXIM, as both (and USB-Specification and the '708 patent) are in the same field (*i.e.*, battery charging). Further, MAXIM solves the same problem as the '708 patent, *i.e.*, monitoring charging and discharging of a battery. A PHOSITA reading Kao would have looked to MAXIM, as Kao discloses a Coulomb counter and MAXIM describes a popular such Coulomb counter that was released years before Kao and was still in popular use at the time of Kao, the '708 patent (and beyond). *Id.* ¶0200; Ex. 1015. A PHOSITA would have a reasonable expectation of success in this combination as Kao teaches using a Coulomb counter and MAXIM provides one. *Id.*

1. Claims 1, 14, and 15

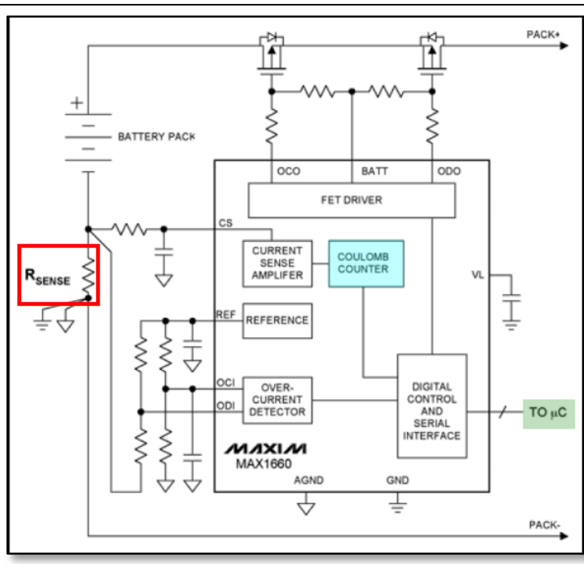
Limitations 1[F], 14[F], 15[I]

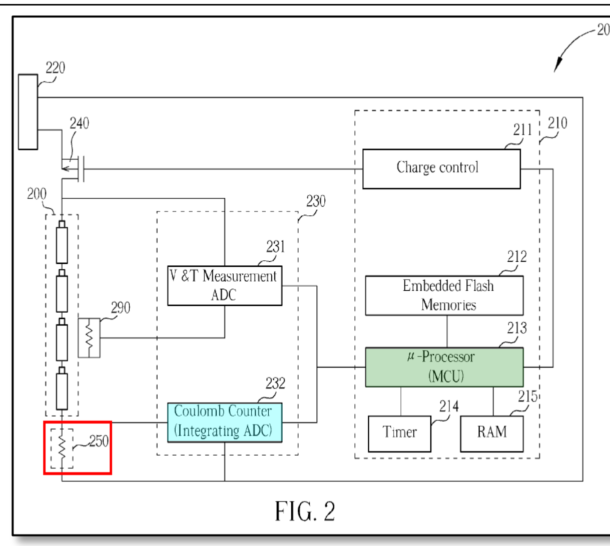
These limitations require that "battery stored charge characteristics comprises [*sic*] a **battery stored charge value based on monitored tracking of battery charging and discharging**." As discussed above when discussing the

respective limitations, having a battery stored charge value based on monitored tracking of battery charging and discharging is inherently disclosed in Kao (or, at the very least, is rendered obvious by it). To the extent that it is not, it is disclosed by Kao and USB-Specification, further in view of MAXIM. *Id.* ¶0201.

In a 2006 advertisement for a 2006 Coulomb-counting fuel-gauge chip, Maxim states that "fuel-gauging devices like the MAX1660 [Coulomb counter] **track charge/discharge currents by monitoring the charges that flow in and out of the battery**." Ex. 1015, p6-7.

Indeed, the exemplary configuration on the MAX1660 is very similar to that of Kao's:

<table>
<tr>
<td>


</td>
<td>


</td>
</tr>
<tr>
<td>Ex. 1015 Fig. 4 (MAXIM)</td>
<td>Ex. 1003 Fig. 2 (Kao).</td>
</tr>
</table>

As shown, the (blue) Coulomb Counter connects across the (red) sensing resistor (R_{SENSE}, #250) and feeds the information to the (green) microprocessor/microcontroller (µC, MCU) via a digital interface. A PHOSITA prior to the '708 patent's priority date would have known monitoring tracked charge/discharge is what a Coulomb counter is used for. Ex. 1005 ¶¶0202-203.

Therefore, Kao renders obvious discloses "battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging [*e.g.*, output of Coulomb counter]." Ex. 1005 ¶0204.

Other Limitations

As discussed in Grounds 1 and 2, each of the remaining limitations of claims 1 and 14-15, and the challenged dependent claims, are disclosed or rendered obvious by Kao.

X. SECONDARY CONSIDERATIONS

As it is Patent Owner's burden to assert secondary considerations, to the extent that it raises any such arguments in a Preliminary Response, Petitioner requests authorization to respond thereto before any Institution Decision.

XI. CONCLUSION

Trial should be instituted and the Challenged Claims should be cancelled as

unpatentable.

Dated: August 25, 2021

Respectfully Submitted,

/ Dion M. Bregman /

Dion Bregman (Reg. No. 45,645)

CERTIFICATION OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Petition includes 13,676 words as counted by Microsoft Word and is therefore in compliance with the 14,000-word limit established by 37 C.F.R. 42.24(a)(1)(i). Accordingly, pursuant to 37 C.F.R. 42.24(d), lead counsel for the Petitioner hereby certifies that this petition complies with the type-volume limits established for a petition requesting IPR.

Dated: August 25, 2021

Respectfully Submitted,

/ Dion M. Bregman /
Dion Bregman (Reg. No. 45,645)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. 42.6(4) and 42.105, lead counsel for Petitioner hereby certifies that on August 25, 2021, copies of this Petition and all supporting exhibits were sent via Priority Mail Express to the correspondence address of record for the ’708 patent:

Locke Lord LLP
IP Docket Department
P.O. BOX 55874
Boston MA 02205

A courtesy copy of this Petition and supporting exhibits was also served via email on Patent Owner’s counsel of record in the district court litigation:

Kasowitz Benson Torres 333 Twin Dolphin Drive Suite 200 Redwood Shores, CA 94065 650.453.5170	Heather S Kim hkim@kasowitz.com Jack Shaw jshaw@kasowitz.com John W Downing jdowning@kasowitz.com Jonathan K Waldrop jwaldrop@kasowitz.com Marcus A Barber mbarber@kasowitz.com
Law Firm of Walt Fair 1508 North Valley Mills Drive Waco, TX 76710 254-772-6400	Mark D Siegmund mark@waltfairpllc.com

Dated: August 25, 2021

Respectfully Submitted,

/ Dion M. Bregman /

Dion Bregman (Reg. No. 45,645)

Appendix A to Petition IPR2021-01400

U.S. Patent No. 8,712,708 Claim Limitation
1[P]: A method, comprising:
1[A]: detecting, by an apparatus, an availability of a charger adapter;
1[B]: determining, by the apparatus, whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics and constant voltage phase charging characteristics;
1[C]: calculating, by the apparatus, a time remaining to charge in the constant current phase based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase; and
1[D]: calculating, by the apparatus, a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase;
1[E]: wherein the time remaining to charge in the constant current phase is based on stored charge characteristics in the constant current phase, when the battery charging point is in the constant current phase and
1[F]: wherein battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging.
2: The method of claim 1, wherein the battery stored charge characteristics comprise data that provides a remaining charging time estimate based on a battery stored charge estimate.
4: The method of claim 1, wherein the time remaining to charge in the constant voltage phase is based on charging current characteristics in the constant voltage phase, when the battery charging point is in the constant voltage phase.
5[P]: The method of claim 1, further comprising:
5[A]: identifying, by the apparatus, a correct category of the charger adapter after detecting its availability; and

U.S. Patent No. 8,712,708 Claim Limitation
5[B]: configuring, by the apparatus, battery charging based in the category of the charger adapter.
6[P]: The method of claim 1, further comprising:
6[A]: identifying, by the apparatus, a correct category of the charger adapter after detecting its availability; and
6[B]: using, by the apparatus, the category of the charger adapter to improve accuracy of an initial remaining charging time estimation.
7: The method of claim 1, further comprising: calculating, by the apparatus, a time remaining to charge in the constant current phase based on the constant current phase charging characteristics and a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant current phase.
13: The method of claim 1, wherein a remaining charging time during the constant voltage phase is estimated as a mapping from charging current, using pre-measured data, when the battery charging point is in the constant voltage phase.
14[P]: A non-transitory computer readable medium, comprising program instructions, which when executed by a computer processor, perform:
14[A]: detecting an availability of a charger adapter;
14[B]: determining whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics and constant voltage phase charging characteristics;
14[C]: calculating a time remaining to charge in the constant current phase based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase; and

U.S. Patent No. 8,712,708 Claim Limitation
14[D]: calculating a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase;
14[E]: wherein the time remaining to charge in the constant current phase is based on stored charge characteristics in the constant current phase, when the battery charging point is in the constant current phase and
14[F]: wherein battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging.
15[P]: An apparatus, comprising:
15[A]: at least one processor;
15[B]: at least one memory including computer program code;
15[C]: the at least one memory and the computer program code configured to, with the at least one processor, cause the processor at least to:
15[D]: detect an availability of a charger adapter;
15[E]: determine whether a battery charging point is in a constant current phase or in a constant voltage phase, based on pre-determined battery charging characteristics, wherein the pre-determined battery charging characteristics comprise constant current phase charging characteristics and constant voltage phase charging characteristics;
15[F]: calculate a time remaining to charge in the constant current phase based on the constant current phase charging characteristics, if the battery charging point is in the constant current phase; and
15[G]: calculate a time remaining to charge in the constant voltage phase based on the constant voltage phase charging characteristics, if the battery charging point is in the constant voltage phase;

U.S. Patent No. 8,712,708 Claim Limitation
15[H]: wherein the time remaining to charge in the constant current phase is based on stored charge characteristics in the constant current phase, when the battery charging point is in the constant current phase and
15[I]: wherein battery stored charge characteristics comprises a battery stored charge value based on monitored tracking of battery charging and discharging.
16: The apparatus of claim 15, wherein the battery stored charge characteristics comprise data that provides a remaining charging time estimate based on a battery stored charge estimate.